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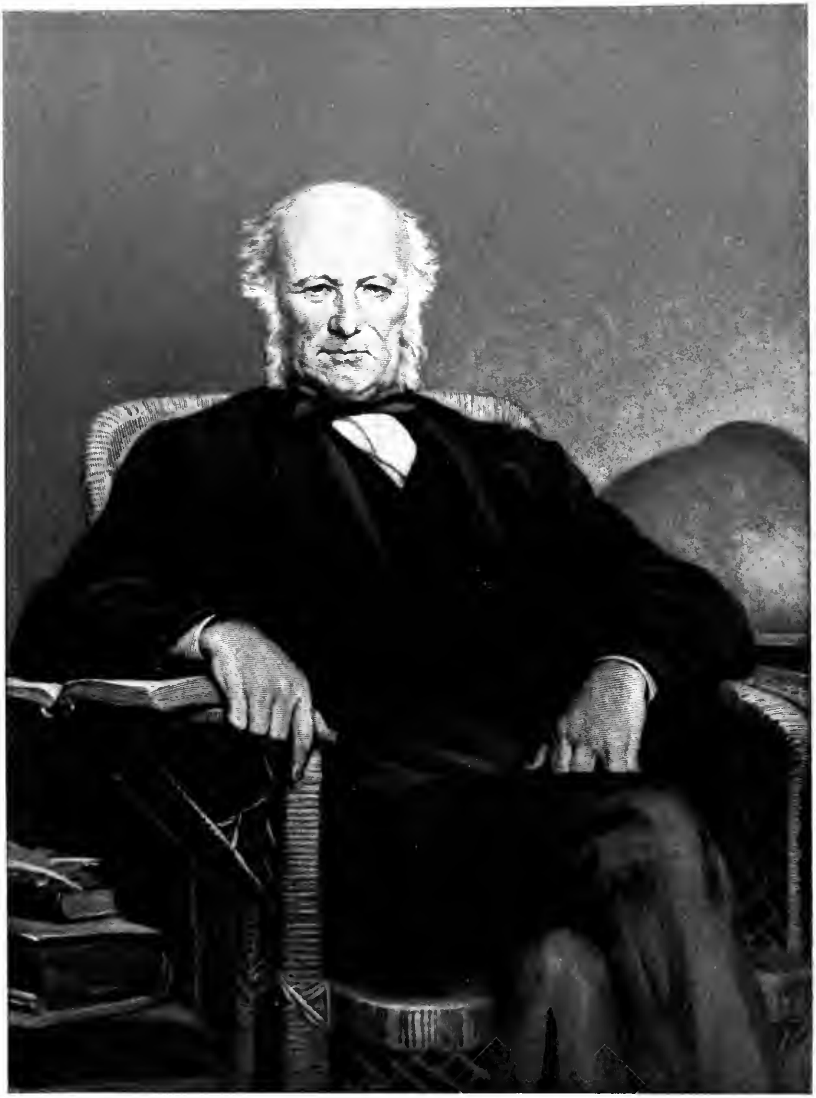

WILLIAM PENGELLY.

APPLETONS' POPULAR SCIENCE MONTHLY.

MAY, 1899.

ALASKA AND THE KLONDIKE.

A JOURNEY TO THE NEW ELDORADO.

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I.—IN BY THE WHITE PASS AND OUT BY THE CHILKOOT.

HARDLY two years ago the names Dawson and Klondike were entirely unknown to the outside world, and geographers were as ignorant of their existence as was at that time the less learned laity. To-day it may be questioned if any two localities of foreign and uncivilized lands are as well known, by name at least, as these that mark the approach to the arctic realm in the northwest of the American continent. One of those periodic movements in the history of peoples which mark epochs in the progress of the world, and have their source in a sudden or unlooked-for discovery, directed attention to this new quarter of the globe, and to it stream and will continue to stream thousands of the world's inhabitants. Probably not less than from thirty-five thousand to forty thousand people, possibly even considerably more, have in the short period following the discovery of gold in the Klondike region already passed to or beyond the portals of what has not inaptly been designated the New Eldorado. To some of these a fortune has been born; to many more a hope has been shattered in disappointment; and to still more the arbiter of fate, whether for good or for bad, has for a while withheld the issue.

In its simplest geographical setting Dawson, this Mecca of the

NOTE.—For most of the photographic illustrations the author is indebted to the work of Curtis, Barley, and E. A. Hegg; especially to the last-named gentleman, of Skaguay and Dawson, is he under obligations for permission to use several of the copyrighted views.

north, is a settlement of the Northwest Territory of Canada, situated at a point thirteen hundred miles as the crow flies northwest of Seattle. It is close to, if not quite on, the Arctic Circle, and it lies the better part of three hundred miles nearer to the pole than does St. Petersburg in Russia. By its side one of the mighty rivers of the globe hurries its course to the ocean, but not too swiftly to permit of sixteen hundred miles of its lower waters being navigated by craft of the size of nearly the largest of the Mississippi steamers, and five hundred miles above by craft of about half this size. In its own particular world, the longest day of the year drawls itself out to twenty-two hours of sunlight, while the shortest contracts to the same length of sun absence.

During the warmer days of summer the heat feels almost tropical; the winter cold is, on the other hand, of almost the extreme Siberian rigor. Yet a beautiful vegetation smiles not only over the valleys, but on the hilltops, the birds gambol in the thickets, and the tiny mosquito, either here or near by, pipes out its daily sustenance to the wrath of man. The hungry forest stretches out its gnarled and ragged arms for still another hundred or even three hundred miles farther to the north.

Up to within a few years the white man was a stranger in the land, and the Indian roamed the woods and pastures as still do the moose and caribou. To-day this has largely changed. The banks of the once silent river now give out the hum of the sawmill, the click of the hammer, and the blast of the time-whistle, commanding either to rest or to work. A busy front of humanity has settled where formerly the grizzly bear lapped the stranded salmon from the shore, and where at a still earlier period—although perhaps not easily associated with the history of man—the mammoth, the musk ox, and the bison were masters of the land. The red man is still there in lingering numbers, but his spirit is no longer that which dominates, and his courage not that of the untutored savage.

The modern history of Dawson begins with about the middle of 1896, shortly after the "public" discovery of gold in the Klondike tract. Three or four months previous there was hardly a habitation, whether tent or of logs, to deface the landscape, and the voice of animate Nature was hushed only in the sound of many waters. At the close of the past year, as nearly as estimate can make it, there were probably not less than from fourteen thousand to fifteen thousand men, women, and children, settled on the strip of land that borders the Yukon, both as lowland and highland, for about two miles of its course near the confluence of the Klondike. Many of these have located for a permanence, others only to give way to successors more fortunate than themselves. Some of the richest claims of the Bonanza, now a famed gold creek of the world, are located hardly twelve miles distant, and the wealth of the Eldorado is discharged within a radius of less than twenty miles. Over the mountains that closely limit the head springs of Bonanza and Eldorado, Hunker, Dominion,

LOOKING DOWN THE LYNN CANAL—SKAGUAY RIVER, WITH SKAGUAY ON THE LEFT.

and Sulphur Creeks thread their own valleys of gold in deep hollows of beautiful woodland—fascinating even to-day, but already badly scarred by the work that man has so assiduously pressed in the region. This is the Klondike, a land full of promise and of equal disappointment, brought to public notice in the early part of 1897, when intelligence was received by the outside world regarding the first important gold location on Bonanza Creek in August of the year previous.

On the 24th of July of the past year I found myself on the principal thoroughfare of Skaguay, the ubiquitous Broadway, contemplating a journey to the new north. The route of travel had been determined for me in part by the non-arrival at Seattle of the expected steamers from the mouth of the Yukon River, and by that woeful lack of knowledge regarding "conditions" which so frequently distinguishes steamship companies. It was to be, therefore, the overland route, and from Skaguay it was merely the alternative between the White Pass and the Chilkoot Pass or Dyea trails. The two start from points barely four miles apart, cross their summits at very nearly the same distance from one another, and virtually terminate at the same body of inland water, Lake Lindeman, the navigable head of the great Yukon River. A more than generous supply of summer heat gave little warning of that bleak and severe interior with which the world had been made so well familiar during the last twelvemonth, and from which we were barely six hundred miles distant; nor did the character of the surroundings betray much of an approach to the Arctic Circle. Mountains of aspiring elevations, six thousand to seven thousand feet, most symmetrically separated off into pinnacles and knobs, and supporting here and there enough of snow to form goodly glaciers, look down upon the narrow trough which today is the valley of the Skaguay River. At the foot of this ancient fiord lies the boom town of Skaguay. Charming forests, except where the hand of man has leveled the work of Nature to suit the requirements of a constructing railway, yet clothe the mountain slopes and fill in the gap that lies between them, shadowing the dense herbage and moss which almost everywhere form an exquisite carpeting to the underlying rock. The ear may catch the strains of a few mosquitoes, or the mellow notes of the robin or thrush, but rising far above these in the majesty of tone and accent is the swish of the tumbling cataracts which bring the landscape of Norway to America. Man, it is claimed, is much the same the world over; but there is a limitation. The second habitation of white man in Skaguay was established less than a year before my visit; yet at that time, presumably to meet the demands of a resident population of nearly five thousand, and of the wandering hordes pressing to the interior, the destructive hand of the advertiser had already inscribed on the walls of rock, in characters twenty feet or more in height, and sufficiently elevated to make them nearly the most conspicuous elements of the landscape, the glories of cigars, the value of mental and physical specifics, and of other abominations which were contrived to fatten the Yankee pocket.

Had it not been for the kindly advice of one who had just returned from the Klondike, and who claimed to have crossed both passes fifty times, I should almost unhesitatingly have taken the

A Summer Day on the Skaguay.

White Pass trail; but the representation that beyond the summit the mud would be neck-deep and virtually impenetrable for a distance of twenty miles or more, cast the decision in favor of the Chilkoot. The fortunate or unfortunate circumstance that a billowy sea made a landing of passengers at Dyea impossible on that day threw me back upon my first resource, and about two hours before midday of the 30th I was mounted on a horse following out the Skaguay trail. By seven o'clock in the evening of the following day I had reached Lake Lindeman, and about a half hour later Lake Bennett, the starting point of the lines of Upper Yukon steamers which had just recently been established. We had made the forty miles of the dreaded White Pass trail without serious hindrance or delay, up over the summit of 2,860 feet elevation, and down over a course which was depicted in colors of hardship that would have done more truthful service in describing a pass in the Himalayas. There was no mud, not a trace of snow or ice except on the mountain declivities, and had it not been for a horse that was both stiff and lame, and required my attention as pedestrian to an extent that had not been bargained for, the journey would have been an exceptionally delightful one.

It is true that an unfortunate fall at one time almost deprived me of my animal, but the service of tackle soon put him to rights and to his feet, and but few blood marks were left on the rocks to tell of the struggle. The most disagreeable incident of the journey was a dense and shifting fog, which so blocked out the landscape of early evening as to necessitate "feeling" the brokenness of a glaciated country in order to ascertain wherein lay the trail. But beyond this there was a perpetual delight in the landscape—in the narrow rocky defile, the bursting torrent, the open meadows, with their carpet of green and variegated with fireweed, gentian, rose, and forget-me-not, which more than compensated for the little vexations that allied themselves with the journey.

It is not often that the selection of a route of travel is determined by the odorous or malodorous qualities which appertain thereto. Such a case was, however, presented here. It was not the depth of mud alone which was to deter one from essaying the White Pass route; sturdy pioneers who had toiled long and hard in opening up one or more new regions, laid emphasis upon the stench of decaying horse-flesh as a factor of first consideration in the choice of route. So far as stench and decaying horse-flesh were concerned, they were in strong evidence. The Desert of Sahara, with its lines of skeletons, can boast of no such exhibition of carcasses. Long before Bennett was reached I had taken count of more than a thousand unfortunates whose bodies now made part of the trail; frequently we were obliged to pass directly over these ghastly figures of hide, and sometimes, indeed, broke into them. Men whose veracity need not be questioned assured me that what I saw was in no way the full picture of the "life" of the trail; the carcasses of that time were less than one third of the full number which in April and May gave grim character to the route to the new Eldorado. Equally spread out, this number would mean one dead animal for every sixty feet of distance! The poor beasts succumbed not so much to the hardships of the trail as to the inhuman treatment, or lack of care and assistance, which they

COMING DOWN THE WHITE PASS—WINTER.

received on the part of their owners. Once out of the line of the mad rush, perhaps unable to extricate themselves from the holding meshes of soft snow and of quagmires, they were allowed to remain where they were, a food offering to the army of carrion eaters which were hovering about, only too certain of the meal which was being prepared for them. Oftentimes pack saddles, and sometimes even the packs, were allowed to remain with the struggling or sunken animal—such was the mad race which the greed of gold inspired.

On October 9th I was again at Bennett, this time returning from my journey into the interior, and full of experience of what steam navigation on the upper six hundred miles of Yukon waters might mean. There was now a change in the sentiment regarding the quality of the two passes. The Pacific and Arctic Railway, the pioneer of Alaska steam railways, was operating twelve miles of track, and had thus materially reduced the "hardships" of the Skaguay trail; the Chilkoot, on the other hand, was represented to be in the worst of mood, and prepared to put the passing traveler into the same condition. It was more than late in the season, but the winter's blasts had been stayed off by a full month, and there were still no signs of their coming. A little ice had begun to form along the river's margin and over sheltered pools, and an occasional cool night made demands for moderately warm clothing proper; but, on the whole, the temperature was mild and balmy, and to its influence responded a vegetation which in its full glory might easily have called to mind the region of the Juniata.

Although strongly warned against taking the Chilkoot Pass so late in the season, many of the outgoers, whose recollections of events in the early part of the year were still vividly fresh, and who could not be persuaded that the period of a few months had so effaced the conditions of the past as to permit a steam railway to enter for twelve miles into the region, chose it in preference to the White Pass. My own mind had been cast in the same direction; not, however, from a point of judicious preference, but merely because I was anxious to see for myself that which had become historic in the movement of 1898, and of instituting a direct comparison of the physical features and general characteristics of the two routes. With no serious hindrance, the journey from Bennett out was that of a full day only, and there was no particular reason to suspect that there would be delay. Snow had fallen on the summit and whitened all the higher points, but seemingly it hung in only a measurably thin crust, and with not enough to necessitate breaking a trail.

A crude steam ferry across Lake Lindeman cuts off about six miles from the first part of the trail, after which a rapidly rising path, sufficiently distinct to permit it to be easily followed, winds over the rocks and among rock *débris* to Long Lake, situated at an elevation of some twenty-six hundred feet, where night shelter is found in a fairly comfortable tent. Up to this point we had encountered but little snow, and the condition of the trail was such as to allow of rapid travel. A wise caution detained us here for the night, and the incoming of a solitary traveler warned us that a blizzard had struck the summit of the pass, and buried it beneath a heavy mantle of snow. Had we been a day earlier we might have crossed dry shod, a very exceptional condi-

Cutting Grade for the Pacific and Arctic Railway—Tunnel Mountain, White Pass Route.

tion at this time of the year, but now the possibilities of a struggle gravely presented themselves. A light frost of the night had fairly congealed the soil, but the lake did not carry enough surface ice to interfere with the progress of a scow, and we reached the farther end without difficulty. The two-mile portage to Crater Lake was largely a snow traverse, but an easy one; at this time, however, it began to snow heavily, and the immediate prospect was anything but cheerful. A low fog hung over the waters, but not so low or so dense as to prevent us from occasionally catching glimpses of the rocks which projected with disagreeable frequency from an assumed bottomless pit or "crater." The ascent from Crater Lake to the summit, somewhat less than three hundred and fifty feet, was made in about half an hour, and then began the steep and sudden plunge which marks the southern declivity of this famous mountain pass. Some little caution was here required to keep a foothold, and a too sudden break might have led to an exhilarating, even if not anxiously sought after, glissade; but in truth, to any one only moderately practiced in mountaineering, even this steep face, which descends for a thousand feet or more from a summit elevation of thirty-four hundred feet, presents little difficulty and hardly more danger. What there is of a trail zigzags in wild and rapid courses over an almost illimitable mass of rock *débris*, at times within sheltered or confined hollows, but more generally on the open face of the declivity. This it is more particularly that carries to many a certain amount of fear in the making of the passage, but, with proper caution and the right kind of boots, nothing of danger need be apprehended.

Unfortunately for the enjoyment of the scenery of the pass, I could see but a modest part of it. Although snow was no longer falling, and the atmosphere had settled down to a condition of almost passive inactivity—much to the surprise, if not disappointment, of a few who had prophesied a stiff and biting wind the moment we passed the divide—heavy cloud banks hovered about the summits, and only at intervals did they afford glimpses of the majestic mountain peaks by which we were surrounded. Enough, however, could be seen to justify for the pass the claims of most imposing scenery, and its superiority in this respect over the White Pass. The temperature at the time of our crossing was a few degrees below freezing, perhaps 25° or 27° F., but our rapid walk brought on profuse perspiration, and it would have been a pleasure, if a sense of proper caution had permitted, to divest ourselves of mackinaws and travel in summer fashion. We made Sheep Camp, with its surroundings of beautiful woodland, shortly after noon, and Cañon City, which, as the terminus of a good coach road to Dyea, virtually marks the end or beginning of the Chilkoot trail, at two o'clock.

To a mountaineer or traveler of ordinary resource neither the White Pass nor the Chilkoot Pass will appear other than it actually is —i. e., a mountain pass, sufficiently rough and precipitous in places, and presenting no serious obstacle to the passage of man, woman, or child. True, I did not see them at their worst, but they were both represented to be frightfully bad even at the time of my crossing. The seasonal effects, doubtless, do much to modify the character of the trails, and even local conditions must mold them to a very considerable extent. It is not difficult to conceive of miry spots along the White Pass trail, or of snow-swept areas on the Chilkoot, and there

THE FINAL ASCENT TO CHILKOOT SUMMIT—WINTER.

certainly must be times when both trails are in a measure or way impassable. All trails are, however, subject to modifications in character, and even the best is at times sufficiently bad. Trains of pack animals cross the White Pass both winter and summer, and, even with the great loss to their "forefathers," their testimony of steady work is a recommendation of the class of service in which they are engaged. A limited number of cattle and horses have also found their way over the summit of the Chilkoot Pass—some crossing immediately after us—but the trail is too steep on the ocean side to fit it for animal service, although I strongly suspect that were the location in Mexico instead of in Alaska, there would be a goodly number of *caballeros* and *arrieros* to smile at the proposition of presented difficulties. Indian women seem to consider it no hardship to pack a fifty-pound sack of flour and more over the summit, and there are many men who do not hesitate to take double this load, and make several journeys during the same day. It is the load that kills, and it was, doubtless, this influence, united to a cruel method, which so strongly impressed the pioneers with the notion of extreme hardship. The most level and perfect road, to one carrying for miles a pack of from sixty to eighty pounds, soon begins to loom up a steep incline.

Both the northern and southern slopes of the Chilkoot Pass are largely surfaced with shattered rocks, over which, with occasional deflections across more pleasant snow banks, a fairly well-defined trail mounts on either side to the summit. In its grim landscape effects, more particularly on the inner face, where a number of rock-bound tarns—Crater Lake, Long Lake, Deep Lake—afford a certain relief to the degree of desolation which the scene carries, it reminded me much of the famous Grimsel Pass, and here as well as there the modeling of the surface through glacial action was strongly in evidence. The vastly towering Alpine peaks were, however, wanting, and the glaciers that still appeared showed that they had long since passed their better days. The actual summit is trenched by a narrow rocky gap, roughly worn through walls of granite, and by it have passed the thousands who have pressed to the interior. There is no timber growth at or near this summit, nor is there soil sufficient to give support to an arboreal vegetation. Nearest to the top line a prostrate form of scrubby hemlock (*Tsuga Pattoniana*) alone makes pretense to being a tree, but below it of itself grows to majestic proportions, and about "Sheep Camp," with Menzie's spruce, a birch, and cottonwood (*Populus balsamifera*), forms part of the beautiful woodland, which with ever-increasing freshness descends to the lower levels.

Lest I be accused of too freely seeing the beauties of the northern landscape, I venture in my defense the following graphic description of the Dyea Valley from the pen of another traveler and geologist, Prof. Israel Russell: "In the valley of the Taiya the timber line is sharply drawn along the bordering cliffs at an elevation of about twenty-five hundred feet. Above that height the mountain sides are stern and rugged; below is a dense forest of gigantic hemlocks, festooned with long streamers of moss, which grows even more luxuriantly than on the oaks of Florida. The ground beneath the trees and the fallen monarchs of the forest are densely covered with a soft, feathery carpet of mosses, lichens, and ferns of all possible tints of brown and green. The day I traversed this enchanted valley was

THE CHILKOOT TRAIL.—POWER HOUSE OF THE AËRIAL TRAMWAY.

bright and sunny in the upper regions, but the valley was filled with drifting vapors. At one minute nothing would be visible but the somber forest through which the white mist was hurrying; and the next the veil would be swept aside, revealing with startling distinct-ness the towering mountain spires, snowy pinnacles, and turquoise cliffs of ice towering heavenward. These views through the cloud rifts seemed glimpses of another world. Below was a sea of surging branches that filled all the valley bottom and dashed high on the bordering cliffs. Much space could be occupied with descriptions of the magnificent scenery about Lynn Canal, and of the wonderful atmospheric effects to be seen there, but the poetry of travel is foreign to these pages, and must be left for more facile pens."

In its present condition the Chilkoot trail has the advantage over the Skaguay in its shorter length, the distance from Dyea to the head of Lake Lindeman, the virtual head of river navigation, being about twenty-four miles; from Skaguay to Bennett, along the usual White Pass trail, the distance is fully ten or twelve miles longer, although a cut-off by way of the summit lakes reduces the traverse considerably. At intervals along both routes fairly good accommodation can now be had. One condition of the Chilkoot Pass, and that a not altogether light one, places it during certain months at a disadvantage as compared with the White Pass. I refer to the dangers from avalanches. These are of the true Alpine type, having their source in the heavy beds of snow which cling with bare support to the steeply pitching mountain walls, in places along some of the narrowest parts of the pass. The appalling catastrophe of April, 1898, which caused the loss of sixty-three lives, and followed closely upon an earlier event of like nature, had its seat in the steep, rocky ledges of the east wall between Sheep Camp and the Scales. It is claimed that the Indians along the trail clearly foresaw the impending event, and announced it in unmistakable language, but their warnings were allowed to go unheeded. They themselves did not make the traverse on that day. The minor disaster of the following December (9th), when but six lives were sacrificed, took place on the steep declivity which faces Crater Lake, not far from the service house of the Chilkoot Pass Aërial Tramway Company. Here the mountain face is very precipitous and gives but insecure lodgment to the snow. The Indians carefully watch all natural signals and urge a rapid journey. However useful these trails may have been in the past, how well or how indifferently they may have met the wants of the pioneers of 1897 and 1898, they are destined before long to be thrown into that same obscurity which they held when the Indians and a few adventurous trappers and traders alone made use of them as avenues of communication between the inner and outer worlds. The advance of the iron horse is now an assured fact, and the Pacific and Arctic Railway, whose construction is engineered by some of the most experienced mechanical talent of Great Britain and America, will minister before many months not alone to the professional interlopers in the new land, but to hosts of tourists as well. The road, which in reaching White Pass summit will have a maximum gradient of a little more than five per cent, is of narrow-gauge construction, solidly supported on dressed ties brought from the forests of Oregon. No terminal ap-

Summit of the Chilkoot Pass, with Impedimenta of Prospectors, April, 1898.

pears to have been as yet definitely determined upon, although the charter act recites Fort Selkirk on the Yukon, about one hundred and sixty miles above Dawson, as such. Operating as it now does sixteen miles or more of road, it is already an extensive freight carrier; but until its completion to Bennett or to some point close to a navigable part of the Yukon River, the Chilkoot Pass tramway, a remarkable construction which crosses over the summit and deposits at Crater Lake, must continue to handle a large part of the business intended for the interior.

It is safe to say that the stirring scenes which were enacted on the passes during the winter of 1897–'98, when the impedimenta of travel and occupation were packed together in the manner of an army camp, will not be repeated again. The past history was a short one, and it gives way to one of greater promise.

THE ORIGIN OF EUROPEAN CULTURE.*

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PREHISTORIC archæology is possessed of a distinct advantage over linguistics in the investigation of racial problems; for human remains are often discovered in connection with the implements, utensils, or trinkets by which the civilization of an extinct people is archæologically determined. To attempt even an outline of the cultural history of Europe would be obviously impossible in this place. It would fill a complete volume by itself alone. Furthermore, the short span of forty years since the inception of archæological science has not sufficed to produce complete unanimity of opinion among the leading authorities. Many important questions, especially concerning eastern Europe, are still awaiting settlement. All that we can hope to do is to describe what may be termed a few fixed points in European cultural history. This, as in our discussion of physical origins,† we shall attempt to do by means of definite propositions, concerning which there is now substantial agreement.

I. *In western and southern Europe an entirely indigenous culture gradually evolved during the later stone age. This was characterized by great technical advance in fashioning implements, carvings, and designs in stone, bone, ivory, and copper; by the construction of dolmens and habitations of stone; by pottery-making; and possibly even by a primitive system of writing.*

A marked reaction has taken place during the last ten years among archæologists respecting the course of cultural development in France. It was long believed that after the first crude attempts of the palæolithic epoch an extended *hiatus* ensued, followed by the

* Advance sheets from The Races of Europe, now in the press of D. Appleton and Company, to appear in May. Footnotes and references are herein largely omitted.

† Popular Science Monthly, January, 1898, pp. 304–322.

sudden appearance of a more highly developed civilization, brought by an immigrant broad-headed race from the East. Two waves of invasion were described: the first bringing polished stone, a later one introducing bronze, cereals, agriculture, and the domestication of animals. Not even credit for the construction of the great stone dolmen tombs was granted to the natives in Gaul, for these were all ascribed to an invasion from the North. The undoubted submergence of the primitive long-headed population of France by a brachycephalic type from the East, to which we have already adverted, was held accountable for a radical advance in civilization. Even the existence of a bronze age was denied to this country, it being maintained that the introduction of bronze was retarded until both metals came in together from the Orient in the hands of the cultural deliverers of the land. The absence of a distinct bronze age was speedily disproved; but the view that France and western Europe were saved from barbarism only by a new race from the East still held sway. It is represented by the classical school of G. de Mortillet, Bertrand, Topinard, and a host of minor disciples. The new school, holding that a steady and uninterrupted development of culture *in situ* was taking place, is represented notably by Reinach * in France and by Sergi † in Italy. Their proof of this seems to be unanswerable. Granting that it is easier to borrow culture than to evolve it, a proposition underlying the older view, it seems nevertheless that the West has too long been denied its rightful share in the history of European civilization.

A notable advance in the line of culture entirely indigenous to southwestern Europe has been lately revealed through the interesting discoveries by Piette at the station of Brassempuoy and in the grotto of Mas d'Azil. Carvings in ivory, designs upon bone, evidence of a numerical system, of settled habitations, and, most important of all, of a domestication of the reindeer, of the horse, and the ox in the pure stone age have been found; and that, too, in the uttermost southwestern corner of Europe. In the lake dwell-

NEOLITHIC IVORY CARVING. Mas d'Azil.
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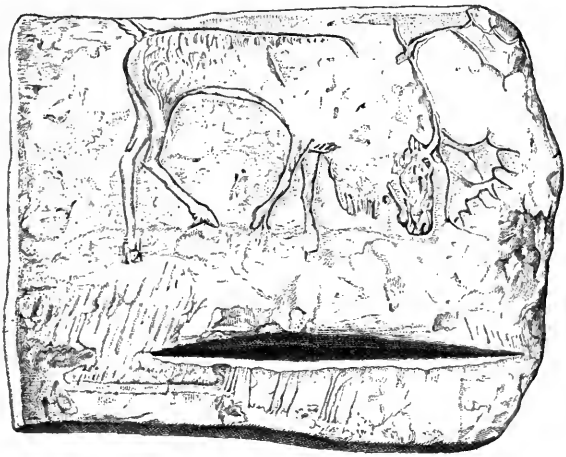
* Le Mirage Orientale, 1893 a; and in his admirable outline of sculptural origins in Europe (1894–'96).

† Arii e Italici, Torino, 1898, especially pp. 199–220.

ings of Switzerland, as also in Scandinavia, a knowledge of agriculture, pottery, and the domestication of animals is evinced, likewise as a native discovery. From other quarters of the continent in the stone age comes similar testimony to a marked advance of man culturally. The justly celebrated carving of a reindeer from Thayngen, almost worthy of a modern craftsman, betrays no mean artistic ability. The man who drew it was far from being a savage, even if he knew no metals, and buried his dead instead of cremating them. The evidence as to early domestication of animals is perhaps the most startling. Carved horses' heads, with halters and rude bridles, have been surely identified by Piette and others.



Bone Carving. Thayngen. (After Bertrand, 1891.)

A system of writing seems also to have been invented in western Europe as far back as the stone age.* Letourneau and Bordier have advanced good evidence to this effect, although it is not yet incontestably proved. The Phœnicians were perhaps antedated in their noted invention by the dolmen builders, by the lake dwellers of the earliest times, and, according to Sergi, also by the people of the Villanova pre-Etruscan culture in Italy. In an earlier time still in the Po Valley, as far back as the stone-age *Terramare* period, pottery was made, and that, too, of a very decent sort. And all this time there is not the slightest evidence of contact with or knowledge of the East. As Reinach says, in no dolmen, no lake station, no excavation of the stone age is there any trace of an Assyrian or Babylonian cylinder, or even an Egyptian amulet. Even the jade and nephrite found in western Europe from Switzerland to Norway, which has so long been regarded as evidence of early commerce with the East, he denies as proof of such contact. The case thus put may perhaps be over-strenuously stated, yet one can not but realize from it that western Europe has too long been libeled in respect of its native aptitude for civilization. This is not constituted of bronze alone, nor is its trade-mark

* Reinach, 1893 a, pp. 543–548. G. de Mortillet, 1897, denies the claim.

beginnings of its use. In this early combination of bronze and iron the Hallstatt culture is in strong contrast with the rest of Europe. Almost everywhere else, as in Hungary for example, a pure bronze age—sometimes one even of copper also—intervenes between the use of stone and iron. Here, however, the two metals, bronze and iron, appear simultaneously. There is no evidence of a use of bronze alone. Bearing in mind, what we shall subsequently emphasize in the case of Scandinavia, that in that remote part of Europe man had to put up with the inferior metal for close upon a thousand years before the acquisition of a better substitute, it will be seen that at Hallstatt a remarkable foreshortening of cultural evolution had ensued. Iron, as we have said, was still comparatively rare. Only in the case of small objects, less often in the blades of bronze-handled swords, does this more precious metal appear. But it is far more common than in the earliest Greek civilizations made known to us by Schliemann and others.

Pages of description would not give so clear an idea of this early civilization as the pictures of their lives, which the Hallstatt people have fortunately left to us. These are found in *repoussé* upon their bronzes, and particularly upon their little *situlæ*, or metallic pails. These *situlæ* are, in fact, the most distinctive feature among all the objects which they have left to us. By means of them their civilization has been most accurately traced and identified geographically. On the opposite page we have reproduced the design upon the most celebrated of these *situlæ*, discovered by Deschmann in 1882, at Watsch in the Tyrol. Another from Bologna, typical of the pre-Etruscan Italian time, will be found upon a later page. Upon each of these, the skill manifested in the representation of men and animals is no less remarkable than the civilization which it depicts. The upper zone of this *situla* from Watsch apparently shows a festal procession, possibly a wedding, for a lady rides in the second chariot. The grooms and outriders betoken a party of distinction. As for the second zone, doubt as to its exact interpretation prevails. Hochstetter declares it to be a banquet, food and entertainment being offered to the personages seated upon chairs at the left. Bertrand is disposed to give it more of a religious interpretation. As for the contest between gladiators armed with the cestus, all is plain. The spectators, judges, even the ram and the helmet for reward of the victor, are all shown in detail. It is not necessary for us to cite more evidence. A civilization already far from primitive is surely depicted. As for its date, all are agreed that it is at least as early as ten centuries before Christ; * not far, that is to say, from the supposed Homeric epoch in Greece.

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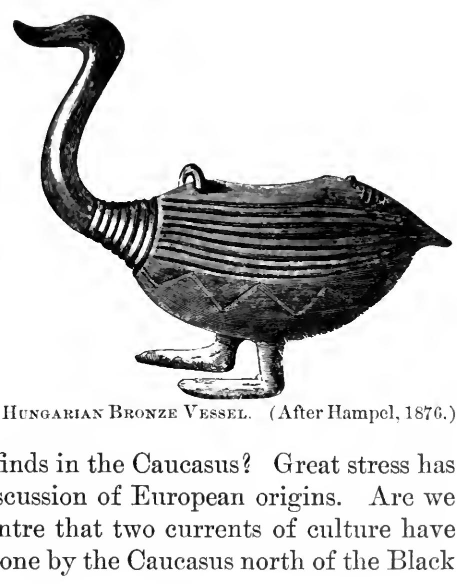
* Hoernes, 1892, p. 529; Bertrand, 1876 a, second edition, pp. 207–216, fixes about 800 B. C.; but 1894 a, p. 80, carries it back to 1200–1300 B. C.

The Hallstatt civilizations betray unmistakable affinities with three other prehistoric European cultures, widely separated from one another. It contains many early Greek elements; it is very similar

Bronze Breastplate from Olympia. (After Furtwaengler's Olympia, 1892.)

to a notable prehistoric culture in the Caucasus Mountains; and it resembles most nearly of all perhaps the pre-Etruscan civilization in Italy. With the third of these—the Italian—it seems to have been most nearly upon terms of equality, each borrowing from the other, after a fashion of which we shall have occasion to speak shortly. On the other hand, the relation of the Hallstatt culture to that of Greece and Caucasia seems to be somewhat more filial rather than fraternal. In describing the area of this civilization, we have seen how firmly it is intrenched all through the southern part of Austria-Hungary and well over into the north of the Balkan peninsula. A comparison of Furtwaengler's magnificent collection of objects from Olympia with those of Hallstatt instantly reveals their similarities. To make this clear, we have reproduced one of the Olympian breastplates, ornamented with figures, which at once suggest those upon the *situla* from Watsch above described. This design is doubly interesting. It shows us a slightly higher stage of the art of figural representation, as well as of conventional design. Not only the men and horses, but the borders, are far better drawn. More than this, we begin to detect a distinctly Oriental motive in other details. The bulls and the lions —lions are not indigenous to Europe nowadays—at once remind us of their Babylonian and Assyrian prototypes. We have entered the sphere of Asiatic artistic influence, albeit very indistinctly. This design here represented, it should be said, is rather above the average of the Olympian finds of the earlier epoch. Many of the other objects, especially the little votive figures of beasts and men, are much more crude, although always characteristic and rudely artistic in many ways. Through this Olympian stage of culture we pass transitionally on to the Mycenæan, which brings us into the full bloom of the classic Greek.

The Oriental affinities of the Hallstatt culture have been especially emphasized by recent archæological discoveries at Koban, in the Caucasus Mountains. A stage of culture transitional between bronze and iron, almost exactly equivalent to that of the eastern Alps, is revealed. Similarities in little objects, like fibulæ, might easily be accounted for as having passed in trade, but the relationship is too intimate to be thus explained. Hungary forms the connecting link between the two. In many respects its bronze age is different from that of Halstatt, notably in that the latter seems to have acquired the knowledge of iron and of bronze at about the same time. In Hungary the pure bronze age lasted a long time, and attained a full maturity. A characteristic piece is represented herewith. In respect of the representation of figures of animals such as these, Hallstatt, Hungary, and Koban are quite alike.



Hungarian Bronze Vessel. (After Hampel, 1876.)

Have we proved that bronze culture came from Asia by reason of these recent finds in the Caucasus? Great stress has been laid upon them in the discussion of European origins. Are we justified in agreeing with Chantre that two currents of culture have swept from Asia into Europe—one by the Caucasus north of the Black

Sea and up the Danube; the other across Asia Minor and into the Balkan peninsula, thence joining the first in the main center of Hallstatt civilization, east of the Alps? The point seems by no means established. Relationship does not prove parentage. Far more likely does it appear that the Koban culture is a relic or an offshoot rather than a cradle of bronze civilization. And even Chantre, ardent advocate as he is of Oriental derivations, seems to feel the force of this in his later writings, for he confesses that Koban is rather from Mediterranean European sources than that Europe is from Koban. Most probable of all is it, that both Hallstatt and Koban are alike derived from a common root in the neighborhood of Chaldea.

III. *The Hallstatt (or Celtic?) civilization of bronze and iron roughly overlies the present area occupied by the broad-headed Alpine race; yet this type is not always identified with the Oriental culture. It seems to have appeared in Europe in a far lower stage of civilization, and to have subsequently made progress culturally upon the spot.*

To trace any definite connection between race and civilization in Europe is rendered extremely hazardous scientifically by reason of the appearance along with bronze of the custom of burning instead of burying the dead, their ashes being disposed in cinerary urns, jars, or other receptacles. By this procedure all possible clew to the physical type of the people is, of course, annihilated at once. It has become almost an axiom among archæologists that bronze culture and incineration are constant companions. Wherever one appears, the other may confidently be looked for. Together they have long been supposed to be the special and peculiar attributes of a new broad-headed immigrant race from the East. To prove this conclusively is, of course, absolutely impossible for the above-mentioned reason. Of the two, it seems as if incineration would be a more reliable test of race than a knowledge of bronze; for burial customs, involving as they do the most sacred instincts and traditions of a people, would be most persistently maintained, even throughout long-continued migrations. The use of bronze, on the other hand, being a matter of obvious utility, and capable of widespread dissemination commercially, is seemingly of far less ethnic significance.

To indicate the uncertainty of proof in these matters, let us suppose that the Hallstatt civilization, for example, is the result of an immigration of a brachycephalic Oriental civilized race overlying a primitive native long-headed one. That seems best to conform to the data, which northern Italy at least affords. Suppose the new people—call them Celts with the best authorities, if you please—brought not only bronze and iron, but the custom of incineration. Prior to their appearance inhumation was the rule. What would be the result if one attempted to determine the physical character of that people from a study of the remains in their necropoli? All the crania to be found in the graves with the precious objects of bronze would in no wise represent the people who brought that bronze. They burned their bridges behind them at death, and disappeared for good and all. And the remains left to the archæologist would represent precisely that class in the population which had nothing to do with the main characteristics of its civilization. And then, again, we must bear in mind that the interments in these necropoli as a whole, both with burned or buried dead, constitute a selected type. Neither Hallstatt, Watsch, nor any of the burial places of their type were open to the great mass of the common people. They were sacred spots, far removed among the mountains from any centers of population. Only the rich or powerful presumably had access to them. They are no more typical of the Hallstatt people, therefore, than interments in Westminster Abbey are representative of the English masses. All our data are necessarily drawn from a class within a class. Inductions from them must be very gingerly handled.

The situation above described seems to prevail almost everywhere in the Hallstatt cultural area. Two distinct burial customs denote possibly two separate peoples, the inhumers being certainly the older. In the Hallstatt necropolis, for example, about one third of the graves once contained human remains, all the others containing mere ashes. So ancient are these graves that only eight crania from the hundreds of interments of the first class are available for study. These are of a pronounced long-headed type.* The modern populations of this part of Europe are, as we have seen, among the broadest-headed people in the world, as are also all the modern Illyrians. Yet from the great necropolis at Glasinac in Bosnia, with its twenty thousand tumuli, the meager Hallstatt returns are amply corroborated.† The ancient inhabitants were as long-headed as they are pronouncedly of the opposite type to-day. Up in Bohemia and Moravia also, according to Niederle, the first bronze-age people, such as we know them, were still dolichocephalic quite like their predecessors in the pure stone age. And here also is incineration just about frequent enough to make it uncertain whether the human remains are typical or not.

Under these circumstances, three suppositions are open to us. We may hold that these long-headed crania of the Hallstatt people are worthless for any anthropological purposes whatever. This one would certainly be tempted to do were the testimony, such as it is, not so unanimous. Or, secondly, we may assume that these long-headed Hallstatt people belonged to a period subsequent to the appearance of the brachycephalic type in western Europe. If we do so, we place them in the same class with the Teutonic race which so cer-

* Zuckerkandl, 1883, p. 96.

† Weisbach, 1897 b.

tainly appears to overlie this one in the later iron age in Switzerland and throughout southern Germany; for the Helvetians and the *Reihengräber* conquerors from the north surely imposed a novel culture, albeit a militant one, upon the long-settled Alpine people, racially speaking. The Hallstatt civilization is immeasurably too early to permit of this hypothesis. At this time the long-headed Teutonic peoples about Scandinavia were certainly vastly inferior in culture, as we shall attempt to prove shortly. Thus we are forced to the third conclusion if we admit the competency of our cranial evidence—namely, that the Hallstatt people in this early bloom of civilization in Europe were allied to the Mediterranean type of the south. No other source for such a dolichocephalic population is possible. Our stock of types of this kind is exhausted.

It does not require a great credulity to admit of this hypothesis, that the Hallstatt people were of Mediterranean type. Were not the Greeks, the Phœnicians, and the Egyptians all members of this same race? One single difficulty presents itself. Over in Italy, throughout the valley of the Po, an entirely analogous civilization to that of the eastern Alps occurs. Hallstatt and Villanova, Watsch and Bologna, are almost identical culturally. And yet over here in Italy the new culture of bronze and of incineration seems to be borne by a broad-headed people of the same type as the modern one. Thus, for example, at Novilara so long as the bodies were all inhumed, the people were of the long-headed Mediterranean type once indigenous to the whole of Italy, now surviving, as we have seen, only in the southern half. On the other hand, when incineration begins to appear in this place, the human remains still left to us are of a mixed and far more broad-headed type. It would seem admissible to assume that when the modern brachycephalic Alpine race submerged the native one it brought new elements of civilization with it. Many Italian authorities, at all events, agree in ascribing the new culture —call it Umbrian with Sergi, or proto-Etruscan with Helbig—to a new race of Veneto-Illyrian or Alpine physical proclivities. What they have not definitely proved, however, is that any necessary connection between race and culture exists. There is much to show that the broad-headed race came in some time before the introduction of the new arts. Even in the later *Terramare* period, preceding the Italian Hallstatt culture, when stone and copper only are in evidence, a change of physical type in the people apparently begins, just as also in France in the neolithic period.

The most indubitable testimony that the Alpine race did not appear in western Europe, armed *cap-à-pie* with bronze and other attributes of culture, is afforded by the lake dwellings of Switzerland. Here in the pile-built villages of the Swiss lakes we can trace an uninterrupted development of civilization from the pure stone age through bronze and into iron. Beginning at a stage of civilization about equal to that of the ancient Aryan-speaking peoples, judged by the root words known to us; not only knowledge of the metals, but of agriculture, of the domestication of animals, and of the finer arts of domestic life, have little by little been acquired. Equally certain is it that no change of physical type has occurred among these primitive Swiss, at least until the irruptions of the Teutonic Helvetians and others at the opening of the historic period. From the very earliest times in the stone age a broad-headedness no less pronounced than that of the modern Swiss prevailed among these people.* Here would seem to be pretty conclusive proof that the Alpine race entered Europe long before the culture with which its name has been all too intimately associated.

In the outlying parts of Europe, perhaps even in Gaul, it is extremely doubtful whether any closer connection between race and culture exists than in the Alps. It has long been maintained that the brachycephalic people of the Round Barrows introduced bronze into Britain. Surely, as we have already shown, things point to that conclusion.† Beddoe, Dawkins, and other authorities maintain it at all events. Yet Canon Taylor makes it pretty evident that the new race arrived in Britain, as it certainly did in Gaul, considerably in advance of any knowledge of the metals. As for Scandinavia, much the same relation holds true. Both race and culture, as we shall see, came from the south, but it is by no means clear that they arrived at the same time or that one brought the other. In Spain, Siret has asserted that bronze came in the hands of a new immigrant broad-headed race, but the authoritative opinion of Cartailhac discovers no direct evidence to this effect.

The final conclusions which would seem to follow from our tedious summary is this: That the nearly contemporaneous appearance of a brachycephalic race and the first knowledge of metals indicative of Oriental cultural influences in western Europe, is more or less a coincidence. The first civilized peoples of the Hallstatt period seem to have been closely allied, both in physical type and culture, with the Greeks and other peoples of the classic East. Among them, perhaps over them, swept the representatives of our broad-headed Alpine type who came from the direction of Asia. These invaders may have

* This fact has been established beyond doubt by the recent great work of Studer and Bannwarth, Crania Helvetica Antiqua, 1894. *Vide* p. 13. Sergi's attempt to interpret the data otherwise (1898 a, p. 67) is entirely erroneous. Gross's data apparently refer entirely to the later period of Teutonic invasions in the iron age (1883, p. 106). *Cf.* Munro, pp. 537 and 541.

† Popular Science Monthly, December, 1897, p. 151.

been the Scythians, although the matter is incapable of proof. Pressure from this direction set both culture and population in motion toward the west, in much the same way that the fall of Constantinople in the fifteenth century induced the Renaissance in Italy.

IV. *The remarkable prehistoric civilization of Italy is due to the union of two cultures: one from the Hallstatt region having entered Europe by way of the Danube, the other coming from the southeast by sea being distinctly Mediterranean. From these evolved the Umbrian and the Etruscan civilizations, followed in the historic period by the early Latin.*

The earliest culture in Italy worthy the name is found in the *palafitte* or pile dwellings, in the northern lakes, and in the so-called *terramare* settlements in the valley of the Po. The former are not distinguishable from similar structures in the Swiss lake dwellings, but the *terramare* are entirely peculiar to Italy. Their like is not found anywhere else in Europe. Briefly described, they are villages built upon raised platforms of earth, encircled by a moat, and generally having a ditch or small pond in the middle, in which an altar is erected. These complicated structures are built upon the low, marshy, alluvial plains along the Po, but show many points of similarity with the true pile dwellings. The people of this early period were in the pure stone age, with few arts save that of making the coarser kinds of pottery. From their osseous remains, they seem to have been of a long-headed type, quite like their predecessors, who were cave dwellers. After a time, without any modification of the modes of construction of their settlements, new elements appear among these *terramare* people, bringing bronze and introducing cremation. At about the same period, as we have said, the Alpine broad-headed race began its submergence of the primitive Ligurian type, leading to the formation of the north Italian population as we see it to-day. This type surely invaded Italy from the north and northeast.

From the foregoing considerations it will appear that there were two constituent streams of culture and also of men here uniting in the valley of the Po and on the northern slopes of the Apennines. Possibly, as Chantre affirms, these two streams were from a common Oriental source, here being reunited after long and independent migrations. At all events, a remarkable advance in culture speedily ensued, superior to either of those from which its elements were derived. For the civilization unearthed at Villanova, in the Certosa at Bologna, at Este, and elsewhere, while in much of its bronze work similar to the Hallstatt types, contained a number of added features, obviously either indigenous or brought directly from the south. The Hallstatt affinities are especially revealed in the *situlæ* to which we have already called attention. That of Arnoaldi, discovered at Bo-

V. *The northwestern corner of Europe, including Scandinavia, Denmark, and the Baltic plain of Germany, throughout the prehistoric period has been characterized by backwardness of culture as compared with the rest of Europe. It was populated from the south, deriving a large part of such primitive civilization as it possessed from the south and the southeast as well.*

That this region was necessarily uninhabited during the Glacial epoch, long after the advent of man in southern Europe, is indubitable. It is proved by the extent of the glaciated area, which extends on the mainland as far south as Hamburg, Berlin, and Posen, and over the entire British Isles at the same time.* It was by the melting of this vast sheet of ice that those high level river terraces in France and Belgium were formed, in which the most ancient and primitive implements of human manufacture occur. In the area beneath this ice sheet no trace of human occupation until long after this time occurs. This fact of itself, is not absolutely conclusive, for glaciation would have obliterated all traces of anterior habitation or activity. As to the possibility of a tertiary population before the Glacial epoch, it presents too remote a contingency for us to consider, although we do not deny its possibility. It too far antedates prehistory, so to speak.

At the notable International Congress of Anthropology and Prehistoric Archæology at Stockholm in 1874 a landmark in these sciences was established by substantial agreement among the leading authorities from all over Europe upon the proposition now before us.† First of all, every one subscribed to the view that the palæolithic or oldest stone age was entirely unrepresented in Sweden. The earliest and simplest stone implements discovered in the southern part of that country betray a degree of skill and culture far above that so long prevalent in France and Germany. Stone is not only rubbed and polished into shape, but the complicated art of boring holes in it has been learned. Norway also seems to be lacking in similar evidence of a human population in the very lowest stage of civilization. Stone implements anterior to the discovery of the art of rubbing or polishing are almost unknown. Only about Christiania have any finds at all been made. In Denmark some few very rude implements have been found. They are so scarce as to suggest that they are mere rejects or half-finished ones of a later type. The kitchen middens,

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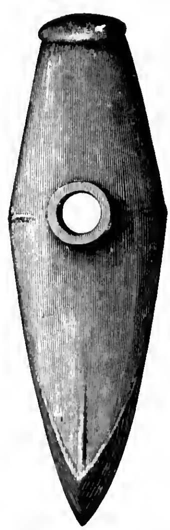
* *Cf.* maps and data in J. Geikie, 1894; Penck, 1884; and Niederle, 1893, p. 25.

† Bertrand, 1876 a and 1876 b, gives a full account of it. The best recent authorities upon Scandinavian culture are Sophus Mueller, 1897, and Montelius, 1895 b. Other works of reference are those of Worsaae, Nilsson, Hildebrand, Madsen and Rygh, full titles being given in our supplementary Bibliography of the Anthropology and Ethnology of Europe. Comprising nearly two thousand titles, it will be provided with a detailed subject index.

or shell heaps, of Jutland, for which the region is most notable, as described by Steenstrup, abound in stone implements. They all represent man in the neolithic age. Polished stones are as abundant as the rudely hammered ones are rare. From the absence of all the very early stone implements, and from the sudden appearance of others of a far more finished type, the possibility of a gradual evolution of culture about Scandinavia *in situ* is denied on all hands. The art of working stone has surely been introduced from some more favored region. The only place to look for the source of this culture is to the south.

Tardy in its human occupation and its stone culture, Scandinavia was still more backward, as compared with the rest of Europe, in its transition to the age of bronze. This is all the more remarkable in view of the rich store of raw materials on every hand. Nowhere else in Europe does the pure stone age seem to have been so unduly protracted. A necessary consequence of this was that stone-working reached a higher stage of evo-

Flint Dagger.
(From Montelius, 1895 b.)



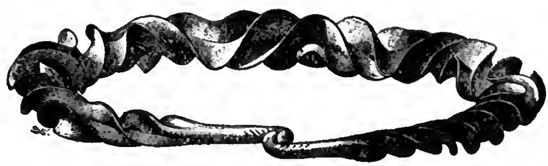
Stone Axe.
(From Montelius, 1895 b.)

Bronze Axe.
(From Montelius, 1895 b.)

lution here than anywhere else in the world save in America. In other parts of Europe the discovery of metal-working, of course, immediately put an end to all progress in this direction. The ultimate degree of skill to which they attained is represented in the accompanying cuts. The first, a flint poniard, shows the possibilities, both in the line of form and finish, of manufacture by the chipping process. To equal this example one must look to the most skillful of the American

Indians, as in Tennessee, where they were too remote from mines of native copper to make use of a ready substitute for stone. Our second implement is an axe hammer, made of diorite. To shape, sharpen, bore, and polish a piece of stone like this certainly required a long apprenticeship in the art.

Bronze culture, when it did at last appear in this remote part of Europe, came upon the scene suddenly and in full maturity. Whether this was as early as the eighth to the tenth century, as Montelius avers, is disputed by many. All are nevertheless agreed that evidence is absolutely lacking that the art was of indigenous origin. From what part of the world this knowledge of bronze ultimately came we leave an open question, as also whether it came with Phœnician traders or direct from Greece, as Worsaae affirms. It was certainly introduced into Sweden, making its way into Norway about the same time directly from the peninsula of Jutland. Its first appearance is in a highly evolved state. Such crude attempts at manufacture as Chantre finds so long prevalent along the Rhone Valley, for example, are entirely absent. Both in form and ornamentation the hand of the master is apparent. This bronze age, like that of stone, lasted a very long time—far longer than anywhere else on the continent. Central Europe passed through three stages of metallic progress while Scandinavia was evolving two. Not until the second or third century of our era—not until the time of the Romans, it would appear—did iron begin to supplant bronze. History repeats itself. The excessive duration of the bronze age, as in the case of stone antecedently, led to the attainment of a remarkable skill. The two accompanying cuts are typical of the best work of this time. In the one case, merely superficial ornament, especially the skillful use of the spiral; in the other, real beauty of form in the bracelet, are clearly apparent. Possessed of such skill in the working of bronze, it is small wonder that the need of a better metal was not felt. Only when fashioned into weapons of war does iron reveal its supremacy over bronze. This, of course, with the campaigns of historical times, brings us to the end of our chronicle.



Bronze Bracelet; 650–500 B. C. (From Montelius, 1895 b.)

The prehistoric experience of metal-working in Scandinavia is typical of the other details of its cultural evolution. In its earliest epoch no trace of domestic animals is present. It is rather a remarkable fact that even the reindeer seems to have been unknown.* What can Penka say to this in his positive affirmation that the original Aryans got up into Scandinavia, having followed the reindeer from central Europe north after the retreat of the ice sheet? The fact is, archæologically speaking, from the evidence furnished by the kitchen middens, that if they ever did this "they left a fine country, where deer were plenty, to subsist upon shellfish on the foggy coasts of Denmark." † The entire absence of economic motive for such a migration is at once apparent. Men seldom travel far under such conditions. Quite early, however, even in the stone age, do evidences of domestic animals occur, to the dog being added the ox, horse, swine, and sheep. Pottery in a rude form also follows. Finally, and in apparent coincidence with the bronze culture, comes a new custom of incineration. The dead are no longer buried, but burned. A profound modification of religious ideas is hereby implied. It seems to have been at about this time also that our Alpine racial type entered Scandinavia from Denmark, although, as we have already observed, it is yet far from certain that the new race was the active agent in introducing the new elements of culture. All that we know is that they both came from the south, and reached this remote region at about the same time.

That the origins of culture in Europe are certainly mixed would seem to be about the main conclusion to be drawn from our extended discussion. It has an iconoclastic tone. Yet we would not leave the matter entirely in the air, nor would we agree with Mantegazza (1884) in his conclusion that "Ignoramus" sums up our entire knowledge of the subject. There is some comfort to be drawn even from this mass of conflicting opinions. Our final destructive aim has been achieved if we have emphasized the danger of correlating data drawn from several distinct sciences, whose only bond of unity is that they are all concerned with the same object—man. The positive contribution which we would seek to make is that the whole matter of European origins is by no means so simple as it has too often been made to appear. It is not imperative that conclusions from all the contributory sciences of physical anthropology, philology, and cultural history should be susceptible of interweaving into a simple scheme of common origins for all. The order of races, for example, need mean nothing as respects priority of culture. Nor do the two sciences, philology and archæology, involve one another's conclusions so far as civilization is concerned. Language and industrial culture may have had very different sources; their migrations need stand in no relation to

* Bertrand, 1876 b, p. 40.

† Reinach, 1892, pp. 72–78, for severe criticism of Penka's hypotheses.

one another in the least. Each science is fully justified in its own deductions, but must be content to leave the results of others in peace. Such is the ultimate conclusion to which all the latest authority is tending. Only by a careful comparison of data from each sphere of investigation may we finally hope to combine them all in a composite whole, as many-sided and complex as the life and nature of man itself.

LIQUID AIR.

By IRA REMSEN,
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WATER, the substance most familiar to us, is known in the liquid, in the solid, and in the gaseous state. Everybody knows that by heating the solid it passes into the liquid state, and that by heating the liquid it passes into the form of gas or vapor. So also everybody knows that when the vapor of water is cooled it is liquefied, and that by cooling liquid water sufficiently it becomes solid or turns to ice. In the same way many of the substances that are known to us as liquids, such as alcohol and ether, can be converted into the form of gas or vapor by heat. In fact, this is true of most liquids. The temperature at which a solid passes into the liquid state is called its melting point, and the temperature at which a liquid passes into the gaseous state is called its boiling point. The boiling point of water, for example, is 100° C. (212° F.) in the open air. But the boiling point varies with the pressure exerted upon the surface. The pressure that we ordinarily have to deal with is that of the atmosphere. If the pressure is increased the boiling point is raised, and if the pressure is decreased the boiling point is lowered. In dealing, then, with the conversion of a gas into a liquid, or that of a liquid into a gas, both the temperature and the pressure have to be considered.

Just as water is most familiar to us in the liquid form, so there are substances that are most familiar to us in the gaseous form. In fact, the only gaseous substances that can be said to be familiar to everybody are the gases contained in the air. The principal constituents of the air are nitrogen and oxygen, which form respectively about four fifths and one fifth of its bulk. Besides these gases, however, the air contains water vapor, carbonic-acid gas, ammonia, argon in small quantities, and many other substances in still smaller quantities. For the purposes of this article it is only necessary to have in mind the nitrogen, oxygen, water vapor, and carbonic acid. Of these, the water vapor is easily converted into liquid, as, for example, in the formation of rain, while the other constituents are liquefied with difficulty. The name "liquid air" is applied to the substance that is obtained by converting the air as a whole into a liquid; but in this process the water and the carbonic acid become solid and can be filtered from the liquid so that the latter consists almost wholly of oxygen and nitrogen. A few years ago this liquid was obtainable in only very small quantities. To-day, thanks especially to the efforts of Mr. Charles E. Tripler, of New York, it can be produced in any desired quantity, and at moderate cost. In consequence of this, it has come to be talked about in a familiar way, and many persons have had the privilege of seeing and feeling it, and of learning something about its wonderful properties. The object of this article is to explain the method employed in the production of liquid air, to give an account of some of its properties, and to indicate some of the uses to which it may possibly be put.

In the older text-books of physics and of chemistry certain gases were classed as "permanent," under the impression that these could not be liquefied, and this impression was based upon the fact that all efforts to liquefy them had failed. A brief account of these efforts will be helpful.

Among the so-called permanent gases was chlorine. An English chemist, Northmore, first succeeded, early in this century, in liquefying chlorine. His work was, however, lost sight of, and in 1823 Faraday at the Royal Institution showed independently that this transformation of gaseous chlorine into the liquid can be effected comparatively easily. The method used by him is this: When chlorine gas is passed into cold water it forms with the water a solid product known as chlorine hydrate. If kept well cooled this hydrate can be dried. If then its temperature is raised even to the ordinary temperature of the room, the solid hydrate is decomposed into liquid water and gaseous chlorine. Faraday put some of the solid hydrate into a stout glass tube sealed at one end and bent at the middle. The other end of the tube was then closed. The tube was then suspended so that the two ends were turned downward. On gently warming the end in which was the solid hydrate this was decomposed into chlorine and water. But the gas given off would under ordinary conditions have occupied a much larger space than the solid hydrate. Being prevented from expanding by the tube in which it was inclosed, it was under very considerable pressure. The end of the tube that was not warmed was cooled, and in this end, in consequence of the pressure and the comparatively low temperature, chlorine, which is gaseous under the ordinary pressure of the air, appeared as a liquid. The general method made use of by Faraday in this classical experiment is that which is always made use of for the purpose of liquefying gases, but for some gases pressures very much higher and temperatures very much lower are required. Faraday himself succeeded in liquefying all the gases then known except oxygen, hydrogen, nitrogen, nitric oxide, and marsh gas. He subjected oxygen to a pressure of about one thousand pounds to the square inch, or nearly seventy atmospheres, but it showed no signs of liquefaction. Later experimenters increased the pressure to four thousand pounds to the square inch, with no better results, so that it is not surprising that it came to be held that some gases are permanent.

Within comparatively recent years several gases have been liquefied on the large scale by means of pressure. These are ammonia, carbonic acid, nitrous oxide, and chlorine. Ammonia is used for producing low temperatures, as in breweries and in cold-storage plants and in the manufacture of ice; carbonic acid, for fire extinguishers and for charging beer with the gas; nitrous oxide, for producing anæsthesia; and chlorine in connection with several branches of chemical manufacture. The production of low temperatures by means of liquid ammonia and of liquid carbonic acid will be more fully dealt with further on, when the principles involved will be briefly presented. It is to be borne in mind that these substances are liquefied by means of pressure alone, at temperatures that are easily reached, so that it appears that by mechanical pressure it is possible to produce low temperatures. In 1869 an important fact was discovered by Andrews. It was that for every gas there is a temperature above which it is impossible to liquefy it by pressure. Thus, if chlorine is at any temperature above 146° C. (294° F.) it can not be liquefied. This temperature is called the "critical temperature" of chlorine. The pressure to which the gas must be subjected at the "critical temperature" in order that the gas may be liquefied is called the "critical pressure." In the case of chlorine this is 93.5 atmospheres. Now, the critical temperature of the gases that were called permanent gases are very low—lower than could be reached by the means at the command of earlier experimenters. The critical temperature of oxygen, for example, is −118.8° C. (−182° F.), while that of nitrogen is −146° C. (−230° F.). The critical pressures are 50.8 and 35 atmospheres respectively. As there is no difficulty in obtaining these pressures, the problem of liquefying oxygen and nitrogen and air resolves itself into finding a method of producing temperatures below the critical temperatures of these gases.

It is well known that a temperature somewhat below the freezing point of water can be produced artificially by mixing ice and salt. The ordinary ice-cream freezer is a familiar application of this method of producing cold. Other freezing mixtures that are sometimes used consist of calcium chloride and snow, that gives the temperature —48° C. (—54.4° F.), and solid carbonic acid and ether, that is capable of lowering the temperature to —100° C. (—148° F.). But even with the latter mixture it is not possible to reach the critical temperature of oxygen or that of nitrogen. How, then, is it possible to reach these extremely low temperatures?

In order to answer this question it will be necessary to take into consideration certain temperature changes that are observed when solids are melted and liquids are boiled, as well as when gases are liquefied and liquids are frozen. When heat is applied to a mass of ice at its melting point it melts and forms a mass of water having the same temperature. Heat disappears in the operation. It is stored up in the water. This disappearance of heat that accompanies the melting of ice can be shown in a very striking way by mixing a certain weight of ice with the same weight of water that has been heated to 80° C. (176° F.). The ice will melt and all the water obtained will be found to have the temperature of the melting ice—that is, 0° C. (32° F.). The water of 80° C. is thus cooled down to 0° by the melting of the ice. Again, when heat is applied to water its temperature rises until the boiling point is reached. Then it is converted into vapor, but this vapor has the temperature of the boiling water. During the process of boiling there is no rise in the temperature of the water or of the vapor. Heat disappears, therefore, or is used up in the process of vaporization. Similar phenomena are observed whenever a solid is melted or a liquid is boiled. When, however, a gas is liquefied it gives up again the heat that is absorbed by it when it is formed from a liquid; and so also when a liquid solidifies it gives up the heat it absorbs when it is formed from a solid.

But it is not necessary that a gas should be converted into a liquid in order that it should give up heat. Whenever it is compressed it becomes warmer. Some of the heat stored up in it is, as it were, squeezed out of it. Conversely, whenever a gas expands, it takes up heat and, of course, surrounding objects from which the heat is taken become colder. Now, it is a comparatively simple matter to compress air. Every wheelman knows that, and he also knows that the process causes a rise in temperature; at least he knows it if he uses a small hand pump. With large pumps run by steam any desired pressure can be reached. This is simply a question of securing the proper engines, and vessels sufficiently strong to stand the pressure. It has already been pointed out that several gases are now liquefied on the large scale by means of pressure. It is to be noted that low temperatures can be produced by converting certain gases, such as ammonia and carbonic acid, into liquids, and by compressing certain gases, as, for example, air. When liquefied gases are used it is only necessary to allow them to pass rapidly into the gaseous state, when more or less heat is absorbed. This is the basis for the use of liquid ammonia in the manufacture of ice. A vessel containing the liquid ammonia is placed in another containing water. The inner vessel being opened, the liquid ammonia is rapidly converted into the gas; heat is absorbed from the water; it freezes. When a vessel containing liquid carbonic acid is opened so that the gas that is formed escapes through a small valve, so much heat is absorbed that a part of the liquid carbonic acid is itself frozen. In this case the substance is present in all three states of aggregation—the solid, the liquid, and the gaseous. The use of a mixture of ether and solid carbonic acid as a freezing mixture has already been referred to. Its value depends, of course, principally upon the fact that solid carbonic acid is liquefied, and the liquid then converted into gas, both of which operations involve absorption of heat.

We are now prepared to understand the important experiments of Cailletet and of Pictet, the results of which were published in 1877. It should be said that they worked independently of each other—Cailletet in Paris and Pictet in Geneva. Pictet liquefied carbonic acid and sulphur dioxide by pressure. The liquid carbonic acid was passed through a tube that was surrounded by liquid sulphur dioxide boiling in a partial vacuum. The liquid carbonic acid thus cooled was then boiled under diminished pressure in a jacket surrounding a tube in which the gas to be liquefied was contained under high pressure. When this gas was allowed to escape from a small opening its temperature was so reduced by the expansion that a part of it was liquefied in the tube and passed off as a liquid. Cailletet worked in essentially the same way, but on a smaller scale. Neither of these experimenters liquefied oxygen or nitrogen on the large scale, but they pointed out the way that must be followed in order that success may be attained. They destroyed the belief in "permanent" gases.

Later experimenters in this field are Wroblewski, Olszewski, and Dewar, who have been interested mainly in the purely scientific side of the problem, while Linde in Germany, Hampson in England, and Tripler in the United States have their minds on the practical side. Notwithstanding the low temperatures involved in the experiments, a number of heated discussions have been carried on in the scientific journals touching the question of priority. To the unprejudiced observer it appears that all of those named above are entitled to credit. They have all helped the cause along, but just how to apportion the credit no one knows. In a general way, however, some of the results obtained by each in turn should be given. Wroblewski and Olszewski have carried on the work begun by Cailletet and Pictet, and have produced lower temperatures. In the latest form of apparatus used by Olszewski, liquid ethylene is used as the cooling agent. Its boiling point is −102° C. (−151.6° F.). By causing it to boil rapidly under diminished pressure a temperature below the critical temperature of oxygen can be reached. As early as 1891 Olszewski obtained as much as two hundred cubic centimetres of liquid air by this method. Dewar has also made use of liquid ethylene. This was passed through a spiral copper tube surrounded by solid carbonic acid and ether. It was then passed into a cylinder surrounded by another cylinder containing solid carbonic acid and ether. A spiral copper tube, which runs through the outer cylinder and also through the inner cylinder in which the ethylene was boiling under diminished pressure, carried the air. This was liquefied and then collected in a vacuum vessel below. Later he found that air can be liquefied by using liquid carbonic acid alone as the cooling agent. A sectional drawing of his apparatus described in 1896 is given herewith. As he remarks: "With this simple machine, one hundred cubic centimetres of liquid oxygen can readily be obtained, the cooling agent being carbon dioxide, at the temperature of −79°. If liquid air has to be made by this apparatus, then the carbonic acid must be kept under exhaustion of about one inch of mercury pressure, so as to begin with a temperature of −115°."

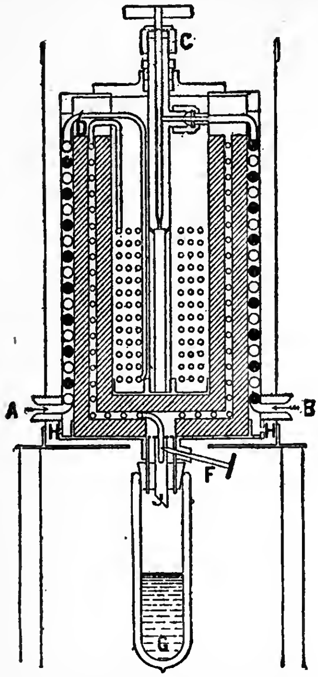


Fig. 1.—Laboratory Liquefaction Apparatus of Dewar for the Production of Liquid Oxygen, etc.

A, air or oxygen inlet; B, carbon-dioxide inlet; C, carbon-dioxide valve; D, regenerator coils; F, air or oxygen expansion valve; G, vacuum vessel with liquid oxygen; H, carbon-dioxide and air outlet; o, air coil; ●, carbon-dioxide coil.

The introduction of the vacuum vessel by Dewar has been of great service in all the work on liquefied gases. A vacuum vessel is a double-walled glass vessel, as shown in Fig. 1, G. The space between the inner and outer walls of the vessel is exhausted by means of an air pump before it is closed. The vessel is therefore surrounded by a vacuum. As heat is not conducted by a vacuum, it is possible to keep specimens of liquefied gases in such vessels for a surprisingly long time. Heat enough can not pass through the vacuum to vaporize the liquid rapidly. The most common form of these vessels is that of a globe. Such a vessel is known as a Dewar globe or bulb.

It has been found that liquid air can be kept very well by putting it in a tin or galvanized iron vessel, which in turn is placed in a larger one, and then filling the space between the two with felt. Under these conditions vaporization takes place quite slowly, and it is possible to transport the liquid comparatively long distances. It has, for example, been transported from New York to Baltimore and Washington. In one case with which the writer is familiar two cans were taken from Mr. Tripler's laboratory in the morning, delivered at the Johns Hopkins University in the afternoon, and used to illustrate a lecture in the evening. After the lecture there was enough left for certain experiments that were carried on during the rest of the night.

Tripler, Linde, and Hampson have all succeeded in devising forms of apparatus by means of which air can be liquefied without the aid of other cooling agents than the expanding air. In principle the methods employed by these three workers are essentially the same. It appears from the published statements that at the present time Tripler's plant is the most efficient. While a few years ago a half pint or so of liquid air is said to have cost five hundred dollars, now five gallons can be made for about twenty dollars, and probably much less. The general working of Tripler's apparatus can be made clear by the aid of the accompanying drawing, Fig. 2. A^1, A^2, A^3 represent steam compression pumps. Air is taken through I from above the roof of the laboratory. In the first pump it is compressed to sixty-five pounds to the square inch. It, of

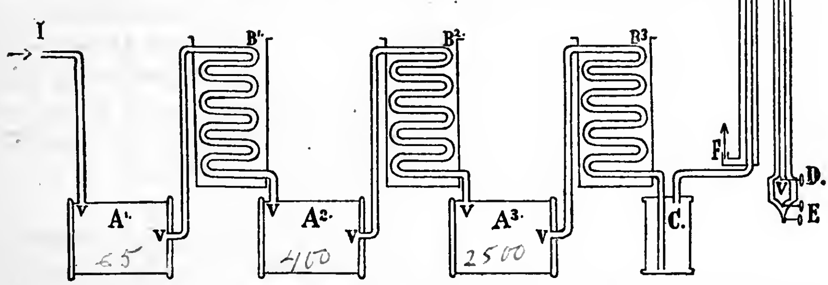


FIG. 2.—DIAGRAM SHOWING WORKING OF COMPRESSION APPARATUS FOR MAKING LIQUID AIR.

course, becomes heated as it is compressed. In order to cool it down again it is passed through a coil, B^1, which is surrounded by water of the ordinary temperature. This compressed and cooled air is then further compressed in the second pump, A^2, to four hundred pounds to the square inch. Again it is cooled in the same way as before by means of water which circulates around the coil B^2. Once more the air is compressed, this time in the cylinder A^3, in which it is subjected to a pressure of two thousand to twenty-five hundred pounds to the square inch; and then this compressed air is brought down to the ordinary temperature in the cooler B^3. The air under this great pressure is now passed through the purifier C, where it is freed from particles of dust and to a great extent from moisture. From C the air passes into the inner bent tube, about thirty feet in length, until it reaches D. This may be called the critical point of the apparatus. Here is situated a needle valve from which the air is allowed to escape. It, of course, expands enormously, and is correspondingly cooled. This very cold air passes into the space between the inner and outer tubes, and finally escapes at F. The result of this is that the compressed air in the inner tube is soon cooled down so far that a considerable part of the air that escapes at D appears in the liquid form. This collects in the lower part of the jacket, and on opening the stopcock at E the liquid escapes in a stream the size of one's finger.

In Mr. Tripler's laboratory the liquid is collected in the cans already referred to. Although for the reasons mentioned the evaporation of the liquid is comparatively slow, it is constantly going on, and as the gas formed occupies a very much larger volume under the pressure of the atmosphere than the liquid from which it is formed, it is necessary to leave the cans loosely covered. Otherwise the pressure would increase to such an extent as to burst any but the strongest vessels. One cubic foot of liquid air gives at atmospheric pressure eight hundred cubic feet of gaseous air.

Liquid air obtained as described is a turbid, colorless liquid. The turbidity is due to the presence of solid water and solid carbonic acid. By passing the liquid through a paper filter the solids are removed, and a transparent liquid is thus obtained. This, as already stated, consists mostly of nitrogen and oxygen in the proportion of about four fifths of the former to one fifth of the latter. Though it should not be forgotten that this liquid contains argon in small quantity, besides three or four other substances in still smaller quantities, as has recently been shown by Professor Ramsay, we may disregard everything except the nitrogen and oxygen. Liquid air is a *mixture* of these two substances. They are not chemically combined as hydrogen and oxygen are, for example, in water. This mixture boils at $-191°$ C. ($-312°$ F.), which is the temperature of the liquid as it is in the cans. As the nitrogen boils at a lower temperature ($-194°$ C. or 318° F.) than oxygen ($-183°$ C. or 297° F.), more nitrogen is converted into gas in a given time than oxygen, and after a time the liquid that is left is much richer in oxygen than ordinary air. When liquid air is poured upon water it, being a little lighter than the water, floats, not quietly, to be sure, but in a very troubled way. Soon, however, the liquid sinks to the bottom because the nitrogen, which is the lighter constituent, passes into the gaseous state, and the liquid oxygen which is left is a little heavier than water. The experiment is a very beautiful one. A scientific poet could alone do justice to it. The beauty is enhanced by the fact that while liquid air is colorless, or practically so, liquid oxygen is distinctly blue.

Although liquid air has the temperature $-191°$ C. ($-312°$ F.), one can without danger pass the hand through it rapidly. The sensation is a new one, but it is evanescent. Very serious results would follow if the hand were allowed to remain in the liquid even for a short time. The tissues would be killed. So also, it is possible to pass the hand rapidly through molten lead without injury. In the latter case the moisture on the hand is converted into vapor which forms a protecting cushion between the hand and the hot liquid; while, in the former case, the heat of the hand converts the liquid air immediately surrounding it into gas which prevents the liquid from coming in contact with the hand.

When the liquid is poured out of a vessel in the air it is rapidly converted into gas. The great lowering in the temperature causes a condensation of the moisture of the air in the form of a cloud. The same thing is seen when the cover is removed from a can containing the liquid. Of course, this liquid does not wet things as water does. When, however, as happened in New York, the lecturer deliberately pours a dipperful of the liquid upon a priceless Worth gown, he may expect to hear expressions of horror from the owner. This experiment passed off most successfully. Every trace of the liquid air was converted into invisible gases before the fleeting agony of the sympathetic audience had passed away.

The effects of very low temperature upon a number of substances have been studied, and some of them can easily be shown. Paraffin, resin, and rubber immersed in liquid air soon become very brittle, and the color of the resin is completely changed. A beefsteak or an onion also becomes brittle, and can be broken into small fragments by the blow of a hammer. A similar effect is produced in the case of some metals. Tin and iron, for example, become brittle, and the tenacity of the iron is greatly increased. A copper wire, however, retains its flexibility. At low temperatures the electric conductivity of all metals is increased. In general, the lower the temperature the greater the conductivity. If a copper wire could by any means be kept cold enough, electrical energy could be transmitted by it with but little loss—perhaps none. Mercury is easily frozen by surrounding it with liquid air, and the solid thus formed is very hard, though if it is cooled down sufficiently it becomes brittle.

Alcohol can be frozen without difficulty by means of liquid air. By the aid of the lowest temperatures hitherto attainable it has only been possible to convert alcohol into a pasty mass. The frozen alcohol is as hard as ice. When alcohol is dropped into liquid air the drops retain the globular form. When taken out on a platinum loop the flame of a Bunsen burner does not set fire to it.

Phosphorescence is greatly increased by cooling substances down to the temperature of liquid air. This has been shown by means of water, milk, paper, eggs, and feathers. An egg and a feather could be distinctly seen in a dark room.

Scarlet iodide of mercury is converted into the yellow variety when it is subjected to the temperature of liquid air. Some other colors are changed under the same circumstances, but not enough is known of this subject to warrant a general statement.

Attention has already been called to the fact that liquid air loses its nitrogen more rapidly than it does its oxygen, and that, after a time, the residue contains a large proportion of oxygen. As combustion is combination with oxygen, combustion or burning takes place more readily in contact with this liquid oxygen than it does in the air. If a lighted match is attached to the end of a steel watch spring, and this then plunged beneath the surface of liquid air, the spring will soon take fire and burn brilliantly, the sparks flying off for some distance in beautiful coruscations. Hair felt, which does not burn in the air, burns in a flash when soaked with liquid air. Finally, when liquid air is confined in any vessel not capable of sustaining an enormous pressure, say about ten thousand pounds to the square inch, the vaporization goes on until the vessel bursts or the stopper is forced out. It might therefore be used as an explosive without any addition, but its manipulation is not altogether simple.

Now for the inevitable question: Of what use is liquid air likely to be? This is a perfectly proper question, and yet, if scientific workers always stopped to ask it, and would not work unless they could find a favorable answer, progress would, to say the least, be much slower than it is. Most great practical discoveries have necessarily passed through the plaything stage. Some of the most important discoveries have not even furnished playthings, and have found no practical applications as this expression is commonly understood. But the production of liquid air, while furnishing mankind with a beautiful and instructive plaything, seems likely to find practical applications. We may look for these in four directions, to each of which a short paragraph may be devoted:

First, as a cooling agent. Low temperature is marketable. To be sure, the demand for the extremely low temperature that can be produced by liquid air does not exist to-day, but this concentrated low temperature can be diluted to suit conditions. The only question to be answered in this connection is, then, What is the cost of cold produced by liquid air? It is impossible for any one to answer this question at all satisfactorily at present. It can only be said that this is what experimenters are trying to find out. It appears, however, that they are on the way to cheap liquid air, and that as the processes are improved the price will become lower and lower.

Second, for the construction of motors. There is no doubt that liquid air with its enormous power of expansion can be used as a source of motive power just as compressed air is. In the case of steam it is necessary to heat the water in order to convert it into steam, and to heat the steam to give it the power of expansion. The cost is, in the first instance, that of the fuel. Given a certain amount of heat, and a certain amount of work is obtained. If liquid air is used, the problem is much the same. Engines must be run in order to compress the air which is to be liquefied. Every gallon of liquid air has been produced at the expense of work of some kind. Now, the question arises at once, What proportion of the work that was put in that gallon of liquid air in the course of its production can be got out of it again? It is certain that all of it can not be got out unless all that we have ever learned about such matters goes for nothing. In dealing with the problem of the application of liquid air as a source of motive power we are therefore doubly handicapped. In the first place, we do not know the cost of the liquid when produced on the large scale; and, in the second place, we do not know the probable efficiency of a liquid-air motor. I say "*we* do not know." Perhaps Mr. Tripler and the others engaged in the experiments on this subject do know approximately. We certainly can not blame them for not telling us all they know at this stage of the work. It is unfortunate, however, that such a statement as was recently published in a popular magazine should be allowed to gain currency—apparently with the sanction of Mr. Tripler. The statement referred to is to the effect that ten gallons of liquid air have been made by the use of three gallons of liquid air in the engine. If that means that the ten gallons of liquid air are made from air at the ordinary pressure, the statement is in direct conflict with well-established principles. If it means that the ten gallons of liquid air are made from air that has already been partly compressed, we must know how much work has been done before the liquid-air engine began. Leaving out of consideration the question of cost, it may be pointed out that liquid-air engines would have the advantage of compactness, though they would necessarily be heavy, as they would have to be strong enough to stand the great pressure to which they would be subjected.

The third application of liquid air that has been suggested is in the preparation of an explosive. In fact, an explosive has been made and used for some time in which liquid air is one of the constituents. When the liquid from which a part of the nitrogen has boiled off is mixed with powdered charcoal, the mixture burns with great rapidity and great explosive force. "To make this explosive, Dr. Linde pours the liquid containing about forty or fifty per cent of oxygen on fragments of wood charcoal, two or four cubic millimetres in size. These are kept from scattering under the ebullition of the liquid by mixing them into a sort of sponge with about one third of their weight of cotton wool." Of course, this explosive must be made at or near the place where it is used. It has been in use in the way of a practical test in a coal mine at Pensberg, near Munich. It is claimed that the results were satisfactory. The chief advantage of the explosive is its cheapness, and the fact that it soon loses its power of exploding.

Finally, the fourth application of liquid air is for the purpose of getting oxygen from the air. This can be accomplished by chemical means, but the chemical method is somewhat expensive. Oxygen has commercial value, and cheap oxygen would be a decided advantage in a number of branches of industry. It will be observed that it is the liquid oxygen that makes possible the preparation of the explosive described in the last paragraph. Oxygen as such in the form of gas is of value in Deacon's process for the manufacture of chlorine. In this process air and hydrochloric acid are caused to act upon each other so as to form water and chlorine. The nitrogen takes no part in the act, and it would be an advantage if it could be left out. It is only the oxygen that is wanted. There are many other possible uses for oxygen either in the liquid or in the gaseous form, but these need no mention here.

In conclusion it may safely be said that it is highly probable that liquid air will be found to be a useful substance, but it is impossible at present to speak with any confidence of the particular uses that will be made of it. As work with it is being carried on energetically in at least three countries, we may confidently expect important developments in the near future.

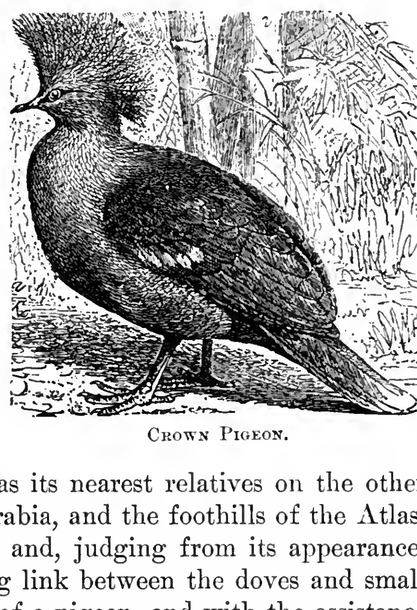
THE PHYSICAL GEOGRAPHY OF THE WEST INDIES.

By F. L. OSWALD.

II.—BIRDS.

THE abundance of birds on the four largest islands of the West Indian archipelago, where indigenous mammals are almost limited to rodents and bats, has often suggested the conjecture that the ancestors of those islanders must have been immigrants from the east coasts of the American mainland; and that theory seems to be confirmed by two facts: the identity, or similarity, of numerous Mexican and West Indian species, and the circumstance that those analogies include so many swift-winged birds.

There are no woodpeckers in the forests of the Antilles, and only two species of large gallinaceous birds, but a prodigious variety of pigeons, swallows, finches, and crows. The *alcedos* (kingfishers) are scarce, but the blackbirds so numerous that some of the countless species seem to claim a South American and even transatlantic ancestry. The restless *estornino* of the Cuban highland forests, for instance, might be mistaken for a varnished starling, resembling the *Sturnus vulgaris* of western Europe in everything but the more brilliant luster of its plumage. The curious



Crown Pigeon.

codornilla, or dove quail, too, has its nearest relatives on the other side of the Atlantic, in Syria, Arabia, and the foothills of the Atlas. It builds its nest on the ground and, judging from its appearance, would seem to form a connecting link between the doves and small *gallinæ;* but its wings are those of a pigeon, and with the assistance of a northeast gale may possibly have carried it across the ocean.

In studying the geographical distribution of animals, we may estimate the prevalence of special genera by the number of their varieties, or by the aggregate sum of individuals, and in the latter sense the migratory pigeons of our forest States once nearly outnumbered all the other birds of North America, though the family is limited to five or six species. But in the West Indies the *Columbidæ* predominate in both respects. Cuba is a country of wild pigeons as preeminently as South Africa is a land of pachyderms and Madagascar sideration the question of cost, it may be pointed out that liquid-air engines would have the advantage of compactness, though they would necessarily be heavy, as they would have to be strong enough to stand the great pressure to which they would be subjected.

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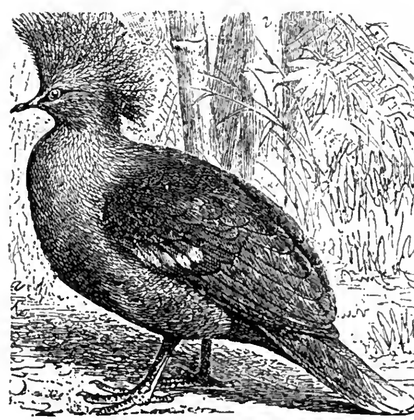
II.—BIRDS.

THE abundance of birds on the four largest islands of the West Indian archipelago, where indigenous mammals are almost limited to rodents and bats, has often suggested the conjecture that the ancestors of those islanders must have been immigrants from the east coasts of the American mainland; and that theory seems to be confirmed by two facts: the identity, or similarity, of numerous Mexican and West Indian species, and the circumstance that those analogies include so many swift-winged birds.

There are no woodpeckers in the forests of the Antilles, and only two species of large gallinaceous birds, but a prodigious variety of pigeons, swallows, finches, and crows. The *alcedos* (kingfishers) are scarce, but the blackbirds so numerous that some of the countless species seem to claim a South American and even transatlantic ancestry. The restless *estornino* of the Cuban highland forests, for instance, might be mistaken for a varnished starling, resembling the *Sturnus vulgaris* of western Europe in everything but the more brilliant luster of its plumage. The curious *codornilla*, or dove quail, too, has its nearest relatives on the other side of the Atlantic, in Syria, Arabia, and the foothills of the Atlas. It builds its nest on the ground and, judging from its appearance, would seem to form a connecting link between the doves and small *gallinæ;* but its wings are those of a pigeon, and with the assistance of a northeast gale may possibly have carried it across the ocean.



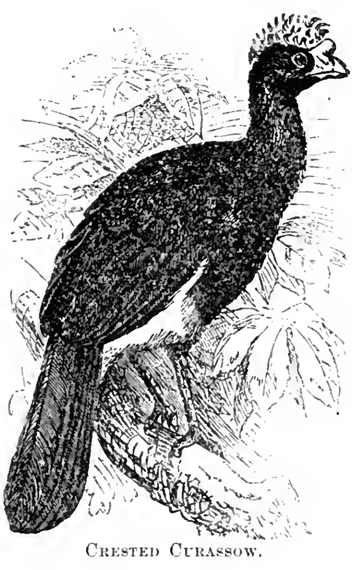
Crown Pigeon.

In studying the geographical distribution of animals, we may estimate the prevalence of special genera by the number of their varieties, or by the aggregate sum of individuals, and in the latter sense the migratory pigeons of our forest States once nearly outnumbered all the other birds of North America, though the family is limited to five or six species. But in the West Indies the *Columbidæ* predominate in both respects. Cuba is a country of wild pigeons as pre-eminently as South Africa is a land of pachyderms and Madagascar of night monkeys. The *Columba leucocephala* (a congener of our ringdove) inhabits the mountain forests in countless swarms, and at the end of the rainy season visits grainfields in such numbers that hundreds are sometimes captured in nets, by means of corn scattered along the furrows.

A closely allied variety is found in San Domingo, where in many upland regions a darkey, equipped with a shotgun and a supply of gunpowder, can dispense with agriculture and raise a family of anthropoids on pigeon pies and *tortillas*, compounded from the grain found in the crops of his victims.

But the *tittyblang* (*tête-blanc*) has scores of smaller and larger cousins, culminating in the Cuban primate of the family, the splendid *paloma real*, with its coronet of pearl-gray plumes and dark-blue wings.

Ducks, too, must number some twenty West Indian species, and one kind of wild geese often obliged the rice planters to employ mounted sharpshooters, who galloped up and down the long dikes, yelling blasphemies, and every now and then enforcing their quotations with a handful of buckshot. But, for all that, the planter could think himself lucky

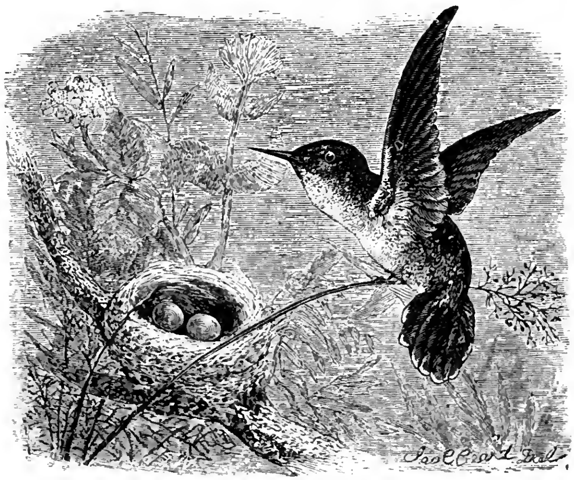


Crested Curassow.

Porto Rico Parrakeet.

to gather a sixty-per-cent harvest of the total produce, for experience soon enabled the long-necked depredators to estimate the target range of the *cazador* within a dozen yards and take wing in the nick of time, only to resume their feast at the other end of the plantation.

A long-continued process of natural selection has also modified the habits of numerous species of West Indian parrots. Four hundred years ago, when Fernan Oviedo superintended the placer mines of Hayti, *loris* were so abundant and tame that his assistants often

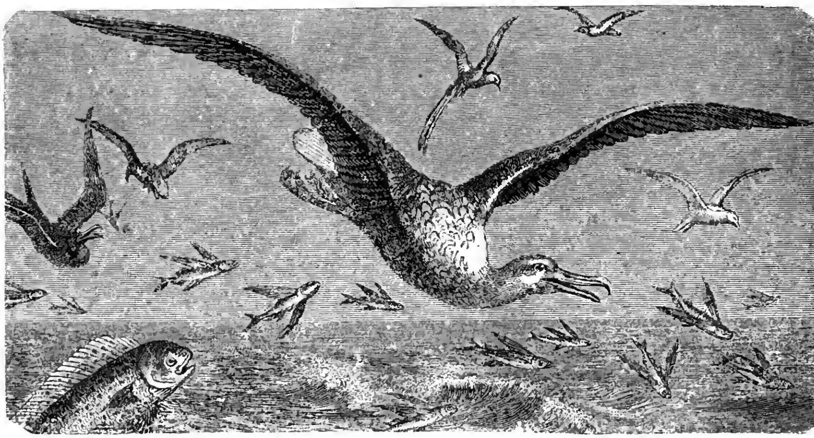


VERVAIN HUMMING BIRD AND NEST.

amused themselves prowling about a thicket of berry bushes and capturing the chattering visitors by means of a common ring net. Nestlings could be taken from every hollow tree, and often from the thatchwork of deserted Indian cabins; but the overconfident specimens came to grief, and the survivors have learned to give the Caucasian varieties of the *Simia destructor* a wide berth. They raise their young in the cavities of the tallest forest trees, and approach human habitations only at dawn of day and sometimes during the noonday heat, when creoles can be relied upon to indulge in a *siesta* nap. In reliance on their protective colors, gray parrakeets frequent the dead timber of the coffee plantations, while the leaf-green Amazon parrot sticks to leaf trees.

"When they alight on a dry branch," says Captain Gosse, in his Jamaica chronicle, "their emerald hue is conspicuous and affords a fair mark for the gunner, but in a tree of full foliage their color proves an excellent concealment. They seem aware of this, and their sagacity prompts them to rely on it for protection. Often we hear their voices proceeding from a certain tree, or have marked the descent of a flock, but on proceeding to the spot, though the eye has not wandered from it, we can not discover an individual; we go close to the tree, but all is silent; we institute a careful survey of every part with the eye, to detect the slightest motion, or the form of a bird among the leaves, but in vain, and we begin to think that they have from the bleak summit regions of the Hindu-Kush to the sierras of Portugal, and from the Atlas to the Norwegian Alps; but there are several exclusively West Indian species of the genus *Corvus*, including a steel-blue rook that flits about the Cuban coffee plantations and has a curious habit of perching on a stump and talking to itself in a sort of croaking chuckle for half hours together.

The *gallinæ*, as might be expected from their limited wing-power, are well represented in the number of individuals, rather than of species. Turkeys, though abundant in the coast forests of Central



THE CARIBBEAN ALBATROSS.

America, are not found wild in any part of the West Indies, where the perennial presence of berries would be as inviting as the absence of foxes.

In the mountains some species of curassow have, however, developed into a stately game bird, the *Oreophasis niger*, or highland "pheasant," that lays a dozen large eggs, and in its courtship season becomes so infatuated that it can be approached and killed with a common walking-stick. The consequent persecution has made it rather scarce in famine-stricken Cuba, but in Hayti it can still be seen in troops of a dozen or more, scratching up the dry leaves of the sierra forests, or pecking at insect-haunted shrubs, exactly like a flock of Tennessee turkeys.

There are also several varieties of true pheasants, and two species of quail (besides the above-mentioned *codornilla*), and in eastern Cuba numerous barnyard chickens have taken to the woods and become so shy that it seems a puzzle how their ancestors in the coast range of Burmah could ever be captured and domesticated. They still practice polygamy, combined with a system of co-operative housekeeping, to judge from the number of eggs that are often found in one nest. At the approach of an unfeathered biped the hen bird takes wing with a screech, and is apt to vanish for the rest of that day. The roosters are rarely seen, their glaring colors having faded into more protective shades of olive and brown, but at dawn of day their shrill reveille can be heard from afar in the heart of the pathless jungle woods.

[*To be continued.*]

INSANE CHARACTERS IN FICTION AND THE DRAMA.

By Prof. CESARE LOMBROSO.

ONE of the things that most strikes one who compares the ancient theater, and even the theater of a few years ago, with the modern theater, is the enormous difference in the character of the personages, and particularly the curious frequency of insane as principal personages in the modern theater. We have come to such a point that one may be almost sure that in reading over a new play, by Ibsen, for example, he will find three or four insane personages in it, if the characters are not all so. These madmen have characteristics so particularized as to seem as if they might have been depicted by an alienist. If the protogenists are not mad, they are agitated by such violent and strange passions as the ordinary world never meets in life; which it therefore refuses to accept when they are described in a scientific book, but nevertheless receives them when it sees them in the scenes or meets them in the romances of the great modern novelists.

Ibsen, for example, has made a most exact picture of the progressive general paralysis which arises, precisely as he depicts it, in men of genius, of great mental activity, who have wasted their hereditary power in pleasures or excessive work; and there is in them both impulsiveness and want of will power, complete perversion of all the instincts, and mental confusion, alternating here and there with genial flashes; but he is wrong in accumulating in a single subject the maladies of a large number of diseased, and therefore exaggerating their eccentricities—as he exaggerates atavism and heredity of disease when he makes the morbid son repeat the same incoherent phrases as the father from whom he inherits his disorder used.

Just and true, however, is that other form of heredity under which from a father corrupted by licentious indulgence and by alcohol, and criminally vicious, is born, besides a paresic son, a lascivious and criminal daughter, who throws herself into prostitution at the first opportunity without any special cause.

So, too, that love of art existing now as only a dream, and that egotistic good nature which enjoys the advantages of a mother's care without gratitude, those short accesses of genial eloquence followed by fury which burst out from the midst of apathy, and which are drowned in the intoxication of alcohol with a complete, immediate forgetfulness of everything, are specific traits of paralytic dementia.

Ibsen, in Hedda Gabber, describes to us a neurotic woman who, being pregnant, and therefore suffering more acute attacks, avenges herself, though married, upon her former lover, who had left her, by burning the manuscripts which he expected to make him famous. Virile, like all criminals, she nursed her resentment from youth.

In the Pillars of Society the great political characters are rogues and neurotics.

In Berkmann the true criminal banker comes into play. He does not kill or ravish, but appropriates the money belonging to his bank under the illusion that he will be able to make great gains with it through the accomplishment of wonderful things that will secure to him his single joy—power; and that he can then restore the sum with redoubled interest.

This case is of a kind of very frequent occurrence, and shows a complete absence in the banker of affection and of moral sense. He sacrifices the woman who loves him to further the desires of an accomplice. He has a faithful friend who, robbed by him, continues to visit him every day and give him the solace of admiration even when all despise him; and he repels him when he fails to absolve him and to believe in the possibility of his return to power. Later the defaulter pretends that he has studied his own case, and has probed it in every way, with the result of a complete acquittal of himself. And why all this? Because he has used the money of others for great purposes: to connect seas, to excavate the millions that are shut up in the bosom of the earth and are crying out to be brought into the light. Thus it is that with the combined genius and delirium of megalomaniacs he hears the call of the minerals and the groaning of the ships longing to be set free. Conscience, duty, and probity do not exist for him. He believes that his quality as a man of genius permits him everything; therefore he sacrifices to his chimeras the beings who love him most. "I am," he says, "like a Napoleon disabled by a shot in his first battle"; and he does not perceive that he has grown old, that he has a mortal heart disease; and he dreams of returning to power and of hearing men ask the benefit of his advice, and no longer talks with anybody, because there is nobody but his old lover who does not believe him guilty.

Finally, repulsed by all, he plunges into the whirl of life and the torment of the mountain, and dies at last of syncope; while his equally egotistical son deserts the mother who adores him to go to the south with the wealthy Amasia, daughter of his father's enemy.

In Dostoievski, madmen, especially epileptics, constitute the absolute majority of the characters; or else they are born criminals, such as my school has attempted to identify by the figures on the hand.

"This strange family," he writes in The House of the Dead, "had an air which attracted notice at the first glance." All the prisoners were melancholy, envious, terribly vain, presumptuous, susceptible, and formal in the highest degree. Vanity ruled always, without the least sign of shame or repentance or the least sorrow over the commission of an offense. Nearly all the convicts dreamed aloud or raved during sleep. Most usually they spoke words of abuse and slang, talked of knife and axe. "We are a ruined people," they said; "we have no bowels; therefore we cry out in the night."

This impossibility of feeling remorse or penitence, along with vanity and exaggerated love of pomp, are characteristics well known to all observers. But other traits were manifested perhaps more conspicuous, and such as are common to children. On feast days the more elegant ones dressed gorgeously, and could be seen parading themselves through the barracks. Pleasure in being well dressed amounted to childishness in them.

Reasoning has no power upon men like Petroff, because they have not any decisive will. If they have, there are no longer obstacles to it. Such persons are born with an idea that moves them unconsciously all their lives hither and thither. They are quiet till they have found some object that strongly arouses their desire; then they no longer spare even their heads. "More than once have I wondered to see how Petroff robbed me in spite of the affection he had for me. This happened to him at intervals, when he had a strong desire to drink. A person like him is capable of assassinating a man for twenty-five soldi, only to drink a litre; on other occasions he would scorn thousands of rubles. He often confessed his thefts to me, lamenting that I no longer had the objects, but showed no penitence for having stolen them; bore reproofs because he thought they were inevitable, or because he deserved to receive them; because I ought to punish him to compensate myslf for the things I had lost, but thought within himself that they were trifles that one ought to be above speaking of."

Further on the novelist speaks of the smuggler by profession, a pleasant fellow, condemned for life for his offenses, who could not lose the instinct for smuggling brandy into the prison. He received only a ridiculous profit, was greatly afraid of the rod, although he had rarely passed under it, wept, swore that he would not offend any more, and then fell down.

Zola also reproduces my epileptic moral madman in *La Bête Humaine*, in the alcoholic in *L'Assommoir*, the paranoiac in Work, and himself confesses to having taken the brief of his immortal chain of romances, Rougon, from a study made by Aubry in a provincial family celebrated for its richness in degenerates, criminals, and insane, all derived from a dull, neurotic Keratry.

Daudet depicts in Jack a series of *mattoidi*, that particular species of insane which I first discovered, that occupies a position between paranoiacs, geniuses, and imbeciles.

Ancient Romance and Theater.—We turn now to the ancient theater and romance. All the Roman novels of Petronius and Apuleius are rich in obscene, mythological, and magical adventures, most improbable and satirical, without ever defining a character or including a real madman.

In the ancient Greek theater, while the idea of heredity is discernible under the form of fate, while violent passion is every now and then depicted under marvelous forms, while anomalies strike us, and furies of Ajax and Dejanira, of Orestes and Œdipus, and the melancholy of Philoctetes, they all still have a common type, which is not perceived in ordinary life. They are madmen who do not exist in any asylum, who seem symbolical, and have little correspondence with the men of the mythological and heroic epoch to which they all belonged; they never, except in Euripides, present a specific personage, nor ever, unless with rare exceptions—as in the Persians of Æschylus and a few other lost works, like the Siege of Miletus—deal with contemporary historical facts.

These poets were concerned with the symbol, the moral, the tradition, and, if I may be permitted the term, the blasphemy, the declamation, rather than with depicting the person. This is further seen in the comedy of the Greek decadence, and still further in that of the Romans, in which, except in the political squibs, the same personages nearly always appear, as well as showing out of the masks intended for the common people—and these figures have come down to us. There are nearly always the old miser or rake, the go-between slave, the braggart soldier. The plots were likewise the same: changed children, reconciled lovers, except in the Greek political satires, in which the demerits of the adversary were exaggerated into the most atrocious caricature, and which became like real humorous journals of the political trifles of the day.

Yet these highly cultivated peoples, agitated by grand public passions, had absorbing, moving controversies—the struggles of the Gracchi, the banishment of Themistocles and Aristides, and the varying fortunes of Marius, of which no trace is found. Nor, for the rest, did the Latins, who were our masters, and were, as we are after them, copyists, followers in the footsteps of their Greek predecessors, readapt contemporary events to their dramatic lines. We in our turn, down to Goldoni and Molière, and even to this very century, have copied those ancient comic and tragic writers, warming them up afresh from Orestes and Clytemnestra, and from events which had not the least echo among us. Trissin, Maffei, and Alfieri delineated more or less, on one side tyrants, on the other tyrannicides, which have little to distinguish them from one another. So in Schiller and Goethe, all the passions are of the scene rather than of personages. Thus Faust, for example, and Margaret, are not persons who have a special character. They are, in fact, personages who cover a symbol, who would tell the story of literature, the story of the beautiful, the skepticism of knowledge, but they tell it with a number of interesting, moving facts, without delineating an individuality. Faust is neither very good nor very bad, since he with his easy way of speaking commits rogueries of every kind till finally he is redeemed. He is a scientific student with a passion for investigation, but in his enthusiasm, instigated by the devil or by doubt, he too often deserts the search for the truth for that of pleasure, too often forsakes the studies that had ennobled his life from youth, and as a man to enjoy the nights of the Brocken, and worse, the favors of Margaret, of Helen, till the moment when he redeems himself by saving a people; but he does this at the last instant, when he is about to die, and has nothing more to enjoy. Margaret, too, is a child like other children, who, like so many others, suffers herself to be beguiled by manly beauty, and has no good qualities except that of being able to die with fortitude, hoping with the penalty to expiate the sin, which is, in fact, more the devil's than hers.

The elder Dumas invented an immense diverting confusion of facts, but his personages are always the same, and are the occasion, the instrument, the setting of the adventures.

The Reasons for this Absence.—The inquiry into the reasons of this absence of insane persons in the older romances and dramas is a curious one. The first cause lies evidently in the law of proceeding in every organism as in every work from the simple to the complex. As in penal law, not the criminal but the crime was studied at first, while now both are studied together; as in primordial medicine only the disease was studied, while now the patient is studied first of all; so in the drama and in comedy, in the measure that the thought has become discriminating, it has substituted or rather associated with observation of the fact *per se*, that of the author of the fact. The study, of course, exacts more acumen, but it also better satisfies our reinvigorated culture and opens broader horizons to us.

We have thus done more than abandon the pedantesque scale of the old time and the mere study of the fact; we have introduced characters into the personages, which, while they correspond to living and real characters that we have under our eyes, attempt to resolve a problem and teach us a moral, and go so far as to represent to us a symbolical idea which is a pure abstraction of the author's, reaching thence the maximum of complication.

Naturally, such salient characters as madmen, eccentrics, and criminals would not be likely to escape the notice of the dramatist, who finds in them motives for great effects without departing from truth and probability.

But there is another more material reason for the recent introduction of insane characters into the theater, and for their greater frequency and participation in real life. It has been remarked that insane persons have multiplied a hundredfold with civilization, to such an extent that where a few years ago one madhouse was enough, now five hundred and six are needed. Taking, for example, the statistics of the most progressive country in the world, those of the United States, furnished by its invaluable census report,* we see that the number of insane persons, which was 15,610 in 1850, 24,042 in 1860, and 37,432 in 1870, rose in 1880 to 91,994; while the population, from 23,191,876 in 1850, increased to 38,558,371 in 1870, to 50,155,783 in 1880—that is, while the population doubled in a little more than thirty years, the insane increased sixfold; so, in the last decade the increase in population was thirty per cent, and that of insane one hundred and fifty-five per cent.

In France † there were 131.1 insane per 100,000 inhabitants in 1883, 133 in 1884, 136 in 1888. These figures indicate that the number of insane is larger in the most civilized countries, and is increasing every year. It may indeed be said that many of these insane are not produced but are only revealed by civilization, and that the opening of the large asylums has caused a considerable number to be brought into the light who were not known of before. It is true that the greater care we give now to the insane, as well as to consumptives, makes them longer-lived. And it is true that as the mind grows enlightened criminals come to be regarded as insane and thus increase the apparent number of such. But all this is not sufficient to explain a doubling in a decade, a tenfold increase in twenty years.

We know, too, that civilization has brought on the development

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* Compendium of the Tenth Census of the United States, Part II, p. 1659. See documents in the new statistical laboratory, the only one in Italy, of Professor Cognetti, recently published at Turin.

† Bodio. Bulletin de l'Institut international de Statistique, 1889, pp. 112 and 123. See some Sanitary Statistics in Italy and other European States, by Dr. Rasori.

of new forms of disease, which hardly existed before. For example, general progressive paralysis was formerly so rare that no special name was given to it till our time, while now it forms the larger quota of the maladies of the wealthy, of thinkers, and of military men. Epilepsy has greatly increased in its psychical form, so that what are called psychical and obscure epilepsy are a revelation of our times, and that its close association with crime (which I believe to be one of the sure facts of modern psychiatry) is still accepted by only a very few alienists, not to say that it is rejected with indignation, and, I will remark, with profound ignorance, by most modern jurists.

Alcoholism, too, has taken on enormous proportions. Not that the ancients did not drink, but rather that pure alcohol had not yet been introduced; while in the middle ages it passed for one of the most efficacious remedies—*aqua vita*, living water. Dr. Beard has made a most judicious observation in America which I have been able to verify in Sicily—that there must be a very advanced degree of civilization, or rather of degeneracy produced by civilization, for inebriety to be transformed into that aggregation of disasters, especially of the nervous system, which is called alcoholism. Now we have not alcoholism only, but morphinism, cocainism, all stimuli of the nervous system, which are used by barbarians as potent excitants, but not to the point of producing stable alterations except in rare cases, like the *amuck* of the Malays.

And now, we all of us, at least in the capitals and the great centers, find ourselves consumed by a feverish activity which makes the mind labor much more than Nature intended it should, under which is produced all this mass of neurasthenics, hystericals, besides the multitudes of moral insane, profoundly egotistical persons, without affection and wholly directed by a powerful passion for gold, for which they sacrifice everything, even salvation!

And, finally, we have that group of semi-insane, which I call *mattoidi*, and who are known as *détraqués* in France and *cranks* in North America—that is, those who have the livery of genius with a substratum of weakness and the practical cunning of the average man, who betray their errors only when they write, who hardly exist save among males (with a few exceptions, like Michel) and in the great centers. I have never seen them in the country. Civilization is now depopulating the country and building up the cities, as it is also augmenting physical excitants with alcoholism, morphinism, etc. Civilization emblazons the baton of the marshal, and not only of the marshal but of the president of the republic, in the eyes of everybody who can read and write. Why, then, should we not suppose that civilization can further derange the equilibrium of mental labor and, indirectly, therefore cause an increase of insanity?

Not only has the number of insane increased, but their importance in society has multiplied fourfold; for which reason we can not fail to give them attention. The morally insane in politics and the megalomaniac insane in the bank who inspired Ibsen are to be found walking around in every country. The blood-criminal, transmuted into the forger and the bankrupt, penetrates into our houses, and we suffer from him every day; while the insane man at first was not regarded, or was adored under the form of a saint or hated as a wizard, possessed of the devil always, or seemed a phenomenon strange to society, a species of extraplanetary meteor. If we add that the degeneration provoked by the abuses of civilization has begotten a multitude of forms akin to madness which afford a field for combinations now tragic, now strangely comic—like the phobia by which one is afraid to cross a room, or avoids a certain group of words, or refuses to know how many doors and windows there are on the street, or can not be at ease without saying sexual pacifying formulas; a class who with their perverted tastes form a real new world apart; and they all may inspire new dramatic settings forth.

As a third cause we add that in our age psychology has penetrated into all departments. There are psychologies of the senses, of the sentiments, of the will, the psychology of the crowd, of the insane, of criminals, and finally the psychology of the cell, or at least of the infusoria (Binet). Therefore, as statistics is applied to history, to politics, to religion, in the same way psychology has at last entered into romance and the drama, and has taken the lion's share. And, far from being repelled by the public, the authors who use it or abuse it, like Euripides and to a certain point Shakespeare, win the admiration of the public; and we are proud to see Zola taking from *L'Uomo delinquente* the Jacques of his *Bête humaine* to make an immortal figure of him, and Dostoiewski depicting innate criminals in his House of the Dead, and the criminaloid in his Crime and Punishment; and we do not despise Bourget when, making more a caricature of psychology than a psychology, he assumes to apply it to the toilets of women and the Parisian *cocottes* under the form of a psychology of love.

It may at first sight seem a contradiction that we have shown that there were also found in antiquity at great intervals dramatic poets and romancers like Shakespeare, Dante, and Euripides who, led by the observing and creative instinct, did not confine themselves to events, but studied characters too, and, keenly perceiving the dramatic potencies in the character of insanity, treasured it up in their works. Thus Euripides depicts Helena, vain even into her old age, saving a part of the hair she was offering at the tomb of her sister so as not to lose what remained of her former beauty; and Orestes has not the simple bestial fury depicted by Æschylus, but has choreic movements, genial intervals, and a tendency to suicide, which show that the author had attained a true conception of the maniac.

In the Mahabharata the maiden Damaianti is described as made insane by love (Book II, st. iii) and Nalo, who, possessed by the demon Kali, stakes his kingdom on the dice, and, denying his wife, abandons her in the wood:

"And with soul slave to the thought, discolored face, and all absorbed in sighs, now lifting up the head, now musing, bereft of sense, you would say; a sudden pallor came on. With mind occupied with one desire, nor sleep, nor the table, nor the sight of familiar friends afforded pleasure, nor day nor night gave repose. Ah! poor miserable one! thus exclaiming and bursting into tears, by that lament, by those soul-sick acts, she was recognized by her friends."

Niceforus has shown how Dante in his Inferno has delineated in the damned the characteristics which my school gives to the born criminal. Shakespeare has done better, and has divined many criminal characteristics through the greater intensity of the crime in the criminal woman. Virile even when compared with the criminal man, Lady Macbeth is crueler than her husband, and, more than that, has many of the characteristics of men:

> "Bring forth men-children only,
> For thy undaunted mettle should compose
> Nothing but males."

And Macbeth, as cool in the crime as the artful contriver of it, is hysterical and hypnotic, and in the accesses reproduces the acts and words of the tragedy, showing that the author knew that hysterics and somnambulists often repeat the acts and the emotions which mark the climax of their malady.

Hamlet has the folly of doubts and hallucinations, simulates the ravings of a madman, but in his suspicious cunning discovers and anticipates what is contemplated to his harm, is homicidal through fear, and is yet often discreet, and a good lover, save that his love vanishes before the fixed idea.

In Ophelia, disappointed love, the contact with a madman or a pretended one, the death of her father almost under her very eyes, provoke a species of madness which would now be called mental confusion, with vague ideas of persecution, dim recollections of love betrayed and of her father, incoherent and confused expressions ending in automatic suicide. This confirms our conclusions.

Genius has also anticipated an epoch in the use and abuse of lunatics, just because time is canceled for genius, because genius anticipates the future work of centuries. But on this subject the inquiry is pertinent why, while in the complaisant literary world such creations as the Argenson of Daudet, the Jack of Zola, and the Eliza of Goncourt find, if not an immediate, a kindly and ready acceptance—while all the great artists, even the most ancient ones, have given the type which I assign to the born delinquents to executioners and criminals—the world has refused to accept the existence of the criminal type of insanity in genius, and the relations in criminals between epilepsy and crime which are nevertheless received in romance and the drama. It is because when we are in the presence of true figures, made to move before us under a strong light by the great artists, the consciousness of the truth which lies dormant in all of us, smothered and broken under distortion by the schools, reawakens, and rebels against the conventional forms which they have imposed; all the more so because the charm of art has vastly magnified the lines of the truth, has rendered them more evident, and has thus much diminished the effort required to master them. If, on the other hand, we base our conclusion upon cold statistics and what I should call a skeleton study of the facts, we find the old views rising in confusion with those of sentiment and the artistic sense, and we arrive at nothing.

COLONIAL EXPANSION AND FOREIGN TRADE.

By JACOB SCHOENHOF.

FIFTY years have elapsed since the adoption of free trade by England. It was hoped that the free entrance of commodities extended to all the world would pave the way to an era of mutual peace and good will. But, judging by the political situation, and taking the armaments as an outward sign of good intentions, the era of peace and good will among nations is certainly far off. To get a trading advantage here and a concession from a semibarbarous country there is still the ambitious striving of the cabinets and the diplomacy of Europe. To give the striving emphasis, industry is taxed to the breaking point and labor to the starving point. Russia exhausts her resources in a railroad through the Siberian waste in her endeavor to obtain an outlet to the sea, which is jealously closed to her at the southwestern end of her dominions by England. The trader of Manchester, fearing for his markets, grows frantic at the prospect of Russian cotton goods being brought to China or to India. The mere acquisition of a port in Manchuria by Russia threatens to seal his doom. But he might look on with complacency. Russia's labor is very dear, capital is dear, wages are on the Asiatic level, famine still stalks through the land, intercommunication is made difficult by the lack of roads, and her wonderful natural resources lie unimproved because the eyes of greed, like those of the dog crossing the stream, are turned on the coveted piece of meat he sees reflected in the water, and to grasp which he drops the one he holds in his mouth. France bristles with bayonets, and is constantly at pains to increase her naval armaments, about whose seaworthiness her own minister of marine expresses suspicions, in obedience to a nervous restlessness for foreign acquisition. England, after her feat in civilizing savages and barbarians in the customary fashion, shown again at Omdurman, is ready to turn her war dogs on France, because the latter has the temerity to demand a slice of Soudanese territory. Well might she have given as hush-money, or for the mere grace of the action, a few thousand square miles of a country closed to access except by the permission of Great Britain, which has successfully pre-empted every desirable bit of land in sight.

Germany, instead of using her newly liberated energies at home in an endeavor to elevate the miserable condition of her working classes, taxes their bread and meat, never too freely supplied, to increase the size of her armies and the number of her battle ships. The defense and expansion of her colonial empire is her leading thought. A strange paradox: The workingman and the peasant are overburdened with taxes on the necessaries of life, so as to procure markets for a limited quantity of factory products outside of the field secured in open competition.

While professing friendship and brotherly love, they all have their eyes on their neighbor's throat, fearful only lest the other might clutch first.

As we are in danger of being drawn into this vortex, it is well to examine the range of possibilities and see what the trade amounts to, to obtain which the scientific intellect of Europe and America has been strained to its limits to discover new means of destruction for attack and defense unknown to the other brothers in the common bond of civilization.

It is a matter of course that trade among European nations does not come within this circle, nor of European nations with the United States. It does not depend on battle ships. In the annexed tables I have classified the countries in three classes: (1) Independent states; (2) colonies of European countries, populated by people of European stock; and (3) colonies and dependencies of European countries, but of non-European stock.

I have reduced the values of imports and exports of the different countries, published in their own currencies, to American dollars. As the values are paper currencies, silver currencies, or conventional values, and of fluctuating rates, I have in such instances taken a yearly average, which will be found in the footnotes of the tables.

I. Trade of Independent Countries other than of Europe and North America.

Names of Countries.	Number of inhabitants.	Importations. Thousands of dollars.	Exportations. Thousands of dollars.	Imports per capita. Dollars.	Exports per capita. Dollars.
Asia (1895).					
China *	383,253	128,772	107,499	.34	.28
Japan †	42,270	90,681	62,443	2.14	1.47
All other states	27,000	30,000	32,000	1.10	1.18
America.					
Argentina ‡	4,000	103,058	108,671	26.50	27.17
Brazil #	16,000	96,000	97,000	6.00	6.06
Chile ‖	2,700	69,200	72,900	25.62	27.00
Peru ^	2,600	7,560	9,000	2.90	3.30
Mexico ◊	12,600	42,000	22,000	3.32	1.76
Uruguay ↕	800	25,000	30,000	31.25	37.50
Venezuela ⇕	2,300	17,000	22,000	7.40	9.56
All other states	11,300	34,000	46,800	3.00	4.14
South Africa					
Independent states	1,000	75,000	12,000	75.00	12.00
Total independent states	505,800	718,271	622,313		
Asiatic states	452,500	249,453	201,942		
American and South African	53,300	468,818	420,371		

* Haikwan tael, 74.9 cents.
† Yen, 52.9 cents.
‡ Peso, gold, 96.5 cents.
\# Milreis, paper (1896), 20½ cents.
‖ Peso, gold.
^ Soler, 43 cents.
◊ Dollar (47 cents) for exports, gold dollar for imports.
↕ Peso, $1.
⇕ Bolivar, 19.3 cents.

The year is 1896, and where a different one is taken it is so marked against the country in the table. The figures only represent the direct merchandise trade. All specie and bullion shipments are eliminated from the account.

II. Trade of India and Dependencies and of Colonies and other Possessions of the United Kingdom (Year ending March, 1897).

Names of Colonies and other Possessions.	Number of inhabitants. Thousands.	Importations. Thousands of dollars.	Exportations. Thousands of dollars.	Imports per capita. Dollars.	Exports per capita. Dollars.
India and its dependencies *	290,690	284,026	378,732	.97	1.30
Colonies.					
Cape Colony	1,820	91,800	39,000	50.04	20.15
Natal	778	18,000	6,500	23.15	8.20
Gold Coast and other Central African possessions	36,700	19,000	17,000	.52	.46
Canada	5,125	118,000	121,000	23.05	24.04
West Indies	3,614	30,000	25,000	8.33	6.94
Australasia and Oceanica	4,793	204,500	210,000	42.65	43.75
Trade of all countries under British flag	343,520	765,326	797,232		
Trade of colonies with white population	16,130	461,320	411,584		
Trade of Asiatic dependencies	290,690	284,026	378,732		

* Rupee, 32 cents. For Straits Settlement and Ceylon, Mexican dollars @ 47 cents.

In examining these tables carefully the reader can form an idea as to how the world's trade is divided, and see what the world is arming to its teeth about.

The only Asiatic country about whose trade the possibilities of war may be entertained is China. Japan has shown her teeth and

III. Trade of Foreign Possessions of all other Countries than the United Kingdom.

Countries and their Colonial Possessions.	Number of inhabitants in thousands.	Importations in thousands of dollars.	Exportations in thousands of dollars.	Imports per capita. Dollars.	Exports per capita. Dollars.
A. France (1894).					
Asia	21,821	16,000	25,000	.73	1.14
Africa, outside of Algeria and Tunis	24,500	13,000	22,000	.53	.50
America and Oceanica	460	14,500	12,600	31.50	27.40
B. Germany (1897).					
Africa	10,200	2,189	1,078	.21	.10
New Guinea	400	72	50	.18	.12
C. Italy.					
Africa	400	5,600	3,000		
D. Netherlands (1895).					
East India	34,000	61,000	89,600	1.80	2.63
E.					
Philippines	7,600	11,000	20,000	1.50	2.63

claws. The history of Poland, Port Arthur, or Kiao-tchow is not likely to find repetition on her territory. Only the defenseless tempt the avidity of the civilizing nations. The import trade of China, an empire with one fourth the population of the entire world, is but half as much again as that of Japan, with but one ninth of the population of the Celestial Empire. Japan's trade has trebled within the last dozen years. Her imports of merchandise are over two dollars *per capita*. Those of China are thirty-four cents. It will be said

Summary of Statistical Tables of the Trade of Colonies and Dependencies of European States and of Independent States other than of Europe and the United States.

Names of Divisions by Countries, Colonies, and Races.	Number of inhabitants in thousands.	Importations. Thousands of dollars.	Exportations. Thousands of dollars.	Inhabitants. Per cent to total.	Imports. Per cent to total.	Exports. Per cent to total.
Totals of tabulations I, II, and III	1,584,099	1,587,758	1,540,858	100	100	100.0
Under British flag	343,520	765,320	797,232	36	48.3	50.0
Under all other flags	605,180	818,779	790,527	64	51.7	49.8
Peoples of European descent	69,430	909,020	831,984	7.3	57.4	52.4
Peoples of other races	879,271	675,079	755,774	92.7	42.6	47.6
Anglo-Saxon	17,130	519,300	407,584	1.8	32.8	25.7
Latin-American	52,300	389,700	424,400	5.5	24.6	26.7
Asiatic races	806,611	618,079	706,274	85.0	39.0	44.0
African races	72,500	57,000	49,500	7.7	3.6	3.6
States and colonies, wool chief export	11,100	441,300	394,500	1.2	27.8	24.9

that China parceled out to modern nations will vastly extend in trading opportunities. So it may. We have, however, national disposition to take into consideration. England has devoted her best efforts to India. After a century spent in bringing the various races to submission, the process of "benevolent assimilation" is helped along by a never-ending flow of capital from England. She has become the teacher and administrator of the people of Hither and Farther India. It is doubtful whether under existing conditions any better government for their three hundred millions could be devised by any outer force. Though England does her utmost, as she understands it, to make the people under her dominion happy and prosperous, although the rule of law and a degree of local independence are established, yet she finds small thanks from her wards. They have their own notions of happiness, and seem to prefer misery of their selection to the advantages of the white man's ordering. The fact is, the brown man and the yellow man have different notions and desires from the white man. No amount of jostling, pushing, and urging will make them take up our views, our tastes, our working methods, except in the due development of time. Our ideas as to necessaries of life and theirs are widely different. Their simple needs are easily supplied from native hands, who understand far better than our potters do the clay they have to deal with. The progress in trade will not be rapid, and will certainly be disappointing to those who expect to see it extend into general lines of merchandise. The import trade of India and its dependencies (1897) is $284,000,000, inclusive of Ceylon and the net trade of the Straits Settlements. This amount, directly catering to the wants of fully three hundred millions of people, is but about one third more than the net import trade of Australasia, with a population of less than five millions of people. The *per-capita* consumption of imported merchandise of the Asiatic possessions of England is ninety-seven cents; of Australasia, $41.66. I must say here in explanation that the values of importations of merchandise, as published in the English returns and lately reproduced by the Bureau of Statistics of the Treasury Department, Colonial Systems of the World, is $305,000,000, which would make a showing of $63.33 *per capita*. But in the English returns the intercolonial trade figures are included. The Treasury Bureau did not mention this in its publication, and gave thereby a basis for erroneous deductions. I have deducted all the intercolonial trade figures of imports and exports from the returns of each of the Australian colonies, so as to bring the figures to a basis of parity with the accounts of Canada, and other colonies and dependencies where no duplications of this kind are possible. The figures of importations remaining over are reduced by this process to £40,500,000, or about $200,000,000—$41.66 *per capita.* The inhabitants of the Anglo-Saxon colonies of the world number but seventeen million. Their net imports of merchandise are $460,000,000. The seven hundred and thirty millions of Hindu and Mongolian populations import $530,000,000. These are the lands of fabled wealth. Antiquity and the middle ages dreamed of riches inexhaustible in connection with their names. To-day still the popular belief is that the wealth of nations is dependent on the conduct of direct trade with the far East. The country can not be rich whose millions find happiness in a sufficient supply of millet or rice, whatever the wealth of a small favored class may be. But these nations were the teachers of the barbarians whose descendants now populate America and Europe. The disciples have improved on the masters. We have improved the tools which they invented and applied new forces of production. We have cheapened the processes of production. We have quintupled, we have decupled time. But whatever our improvements in the tools, they are still our masters in the work. Any one who would endeavor to substitute the product of our mills in cotton, in silk, in wool, in wood, iron, clay, in lacquer, cloisonné, or enamel, for theirs, and not see at a glance the hopelessness, would indeed prove his incapacity for grasping the situation. Our best producers study with profit the work of China and, chiefly, of Japan, and are grateful for the inspiration they derive from it. But they do not attempt to copy. Neither in color effect nor design could they stand the test of comparison. Five thousand years have been recovered from the sepulcher under which they had been sleeping. But the oldest traces unearthed in the valley of the Euphrates still take us back to the farthest East as the originator of what we cover by the term "civilization." The Mongolian shares the lot of all who have benefited the race.

If we can not expect great openings for our mill products in Asia, Africa is a new field for the civilizing efforts of Europe, and will repay cultivating, perhaps. The negro has neither factories nor workshops. There at least is an unlimited field for trade expansion. Germany, the latest comer, with the zeal of all fresh missionaries, is eagerly taking up her colonizing mission. The result is not very encouraging. There is a fine set of buildings with garden spots and harbor improvements in the settlement at Cameroon, and a well-stocked graveyard of what were once good German boys, victims of the deadly climate and of the expansion fever. So far this is the only net showing to the credit side of the ledger. The territory in Africa covers nearly one million square miles. The possession of such an empire is worth a sacrifice, apparently, and Germany is not parsimonious in this direction. The contribution of the German

Government to the administration fund of the African colonies was $2,194,000 in 1896–'97. This does not include the expense of maintaining the military and naval forces stationed in the African settlements. The annual importations of all the colonies amounted (in 1897) to $2,261,000, inclusive of New Guinea. So it costs the Government more than one dollar to enable its citizens to do a dollar's worth of trade. The population is estimated at 10,200,000. What possibilities stretch out before us, if they could be made to wear shirts or uniforms like the native police force, which has been organized at Cameroon! The extent of the territory, however, precludes the possibility of successfully conducting the missionary effort to induce them to wear clothes. The question also remains open what return could be made, even if the recipients could be brought to appreciate the advantage of a fuller covering of their nakedness than the traditional one.

France is in possession of territories in Africa, the population of which is on a more advanced status. The territories of the Senegal have been under French dominion for a period of two hundred years and more, and trade relations with the Senegal and Soudan have been assiduously cultivated. In Asia, Tonquin and Annam were to open the road to a very active trade with China. She has held undisputed lodgment since 1814 in Pondicherry and other towns in India that remained over to her from her East Indian empire conquered by Dupleix and abandoned by Louis XV's weak policy. Still, with all the tender care and an expenditure for the colonial service, as per budget of 1898, of about 80,000,000 francs, and not counting the colonial expense *êtat* of the ministry of war and of the navy, the entire export trade of France to her Asiatic possessions is 35,000,000 francs; to her African dominions, outside of Algiers, 22,000,000 francs; and to her American possessions, with barely five hundred thousand inhabitants, 35,000,000 francs. The territories to which this trade caters have a population of about twenty-two million in Asia and twenty-five million in Africa. If we include the French islands in America and French Guiana, the exports of French merchandise to all her colonies amount to about 95,000,000 francs. If we include the allowance for colonial service from the naval and military budget, France has an expense that exceeds the amount of her colonial export trade. How much better off France would be if she would drop this burden! She could do the same trading and save her money, annually wasted, and her men annually slaughtered to the mania of colonial expansion.

The forty-five millions peopling the French possessions in Asia and tropical Africa consume altogether about $30,000,000 worth of foreign imports. The French share of this is about $11,000,000, or a little over one third—eleven millions of trade against fourteen millions of direct expense. The contributions to the American colonies are but $2,000,000, inclusive of about $1,000,000 to the penal establishment at Cayenne.

Italy's demonstration of the extent to which this madness can carry otherwise sane statesmen is fresh in everybody's memory. Outside of Russia, the poor—meaning the working classes—are in no country of Europe as poor as in Italy. If we take the production per acre in all the cereals as a gauge of interior development, then no European country west of Russia, not excepting Spain, is in a more backward state. Wise statesmanship would have found here a field for cultivation sufficiently large to tax all its energies. The peaceful acquisitions of industry did not satisfy the ambition of the Government. Conquests in equatorial Africa were deemed more essential to the kingdom's material welfare, but lately freed from the deadening grasp of clericalism and absolutism, than the improvement of opportunities lavishly present at home. What she has cultivated at an enormous expense of blood and treasure has borne the ordinary harvest of failure and disaster. The entire import trade of Massowah, to which the whole world contributed, and which is largely a transit trade, amounts to about $5,000,000. The expenditure on account of her Red Sea possessions for the year 1895–'96 is given in the Statesman's Year Book as 123,738,064 lires ($24,000,000). The contribution to the maintenance of this her "white man's burden," from 1882 to 1895, was 303,905,926 lires. At present (1897–'98), after the sobering lesson received in 1896, the net expense is about $3,500,000 (17,000,000 lires).

The three powers—France, Italy, and Germany—point a lesson of unmistakable significance. The figures speak for themselves. No amount of expense can make the African and the Asiatic consume an appreciable amount of European merchandise. No amount of cultivation can make the tropics endurable to the northern man Labor and exertion on his part under the rays of a deadly sun and a miasma-breeding soil are entirely out of the question. Those who would make the endeavor in the manner of the temperate zone would only succeed the sooner in reaching the end of white man's settlement in the tropics, disease and death.

Many point to the Dutch East India settlements as a successful commercial enterprise. But, taking the best construction given to the story from the trader's point of view, the present satisfactory conditions have been reached after a great deal of disappointment, loss, and bloodshed. A large revenue is acquired from Government sales of colonial produce; still, with all this added to the other revenues from land tax, excise, and other duties, the Government has a deficiency of over 10,000,000 florins a year in her East India possessions. The budget for 1898 shows an expense *état* of 146,150,164 florins, which is met by a revenue from all sources of but 135,204,203 florins.

This is the richest part of the Malay world, and for centuries has been in the possession of Europe's most enlightened people. The results, if the *per-capita* unit of imports and exports is taken as a criterion, are not different from those shown in the account of the Philippines, governed for centuries by Spain. The loss of their colonies is ascribed to the oppressive rule which the Spaniards exercised. The Netherlands, devoting all their efforts to the development of the resources of the islands, at least during the greater part of this century, do not show much better results. The imports *per capita* of the Dutch possessions are $1.80, and the exports $2.63. The imports of the Philippines are $1.50 and the exports $2.63 *per capita.*

From this we may be permitted to deduce that the Malay Islands are not likely to prove a more thankful field for cultivation by our traders than to the extent indicated in the trade reports set forth above.

Under the conditions here delineated, it would be inviting all the risks and dangers connected with expansion and colonization, while nothing is to be gained in a commercial sense that can not be realized by the means now in our hands.

All the ends of trade can be attained without territorial expansion. The trade in the hands of peoples under English sovereignty is open to all commerce on equal terms. Not even the sovereign country, except in the recent concessions by Canada, receives a preference. The protection of the British flag is tendered gratis to the colonies and dependencies. The imports of these countries cover about one half of the trade of all the world, outside of Europe and the United States. Though they have but 4.67 per cent of the population, the Anglo-Saxon colonies do sixty-nine per cent of the trade of all the colonies and dependencies of the British Empire.

South and Central America absorb about one fourth—24.6 per cent of imports and 26.7 per cent of exports—of the world's trade here summarized. The colonies peopled by Anglo-Saxon population and the Latin-American states together, though but 7.3 per cent of the inhabitants, do an importing trade of 57.4 per cent of the trade of the world here reviewed. The countries trading under the protection of the British flag and the Latin-American states combined have about seventy-three per cent of that trade among them. All this trade, as well as by far the greatest part of the rest, is incontestably accessible to-day on an equal basis to all the world. The key to it lies in the best terms, the best value. The trader and not the admiral governs the field. Prince Heinrich will not succeed better than Admiral von Diederichs in convincing China of the advantages Germany can offer if Mr. Carnegie's rails are cheaper than Mr. Krupp's. A whole fleet of American battle ships will not convince the Asiatics that our cotton goods are as desirable as the English so long as the latter make goods suitable to their markets, and the Americans offer only products calculated to cover the home demands.

The golden rule is a more effective trade opener than the cannon's mouth. Fair and square dealing among nations does not entail expense, but brings in good returns. Our national policy, however, has been one studiously calculated to array the world against us. Like every policy in behalf of a selfish interest, it injures the foreign people against which it is directed far less than the nation which devises it.

The trade of Australasia, Argentina, and Uruguay, and the Cape is based chiefly on wool and hides. The imports of these countries, numbering but eleven million inhabitants, amount to $440,000,000, equaling in amount the trade of China, Japan, Persia, and India, with their seven hundred and fifty million inhabitants. Though but 1.2 per cent of the population of the world (outside of Europe and the United States), their imports are 27.8 per cent of the totals of the figures in the tables. In exports they do about $400,000,000, or 24.9 per cent of the total sum of exports here given. It would be worth cultivating friendly relations with them. They are inhabited by people of European stock, and come nearer to the standard of life of Americans than any of the other nations of the globe. Our latest effort to draw them closer to us was the Dingley tariff, with its duty of eleven cents a pound on greasy wool and of fifteen per cent on raw hides. The action can not be construed as a very friendly one. But neither is the effect as calculated by the wise heads who insisted on the provisions of the wool tariff, the woolen and worsted manufacturers of the East, and the wool raisers of the West. The wool and woolen trade of America has suffered many vicissitudes during the thirty-five years of high tariffs. It has gone through many periods of depression. But it is doubtful whether at any time more disastrous conditions existed than have marked the twelve months ending at this writing (March, 1899).

The situation can be appreciated from the fact that wool, imported prior to the passing of the Dingley tariff, is being reshipped to England, where it is bringing better prices than can be obtained here under the ægis of the protective duty of eleven cents a pound. Three and a half million pounds were shipped in the seven months ending January 31st.

We should profit by this experience, try to cultivate friendly relations in parts of the world where advantageous trade connections can be established, instead of following the *ignis fatuus* of Asiatic expansion.

THE INTERPRETATION OF NATURE.

By EDMUND NOBLE.

IT is an interesting and suggestive fact in Nature study that at the outset man was thrown utterly upon himself for the very vocabulary of the world-puzzle which presented itself to him for solution. He had not only to unriddle his "inscription in an unknown tongue," but to evolve even the possibility of an explanation out of his inner consciousness. His first theories of the universe were based, not on anything which the cosmos was, independently of him, but upon his own nature and activities as a living animal. This resort to himself as his chief means of interpretation resulted from the very nature of the knowing process; for knowledge of things is never in any absolute sense what things are, but is rather what they are like. When we cognize an object we do it by referring that object to the class of objects which in one or more respects it resembles. And as in this process we draw from the objects most familiar to us the principle of explanation which we need for the less familiar things that have not yet become part of our mental possessions, much depends upon priority in the setting up of mental classes, as well as on the strength of the impression which they make upon the mind. The earliest and deepest class impressions are necessarily those which arise out of man's knowledge of himself—of his body and the parts thereof, of his corporeal activities, and of his feelings and thoughts; next, of the bodies of other men and of their movements; finally, in the order of vividness, of the animate and inanimate objects most nearly related to his life. It is these classes which, by virtue of their priority and strength, naturally acquire dominating influence over all later acquirements, and it is to them that the mind refers the impressions gained from the more remote inorganic world.

Among the simpler illustrations of the effort man makes to assimilate the external system to himself are those with which we are more or less familiar in the domain of language. We find them first in the forms for gender by which, in all inflectional tongues, inanimate objects are to this extent likened to living animals. A similar tendency is at work in the widespread lingual habit of naming things after parts of the body, as in the case of "door," called the "eye of the house" by the native of Banks' Island; of "son-tree," the term applied by the Siamese to "fruit"; of the Malay's use of the noun "child" for "lock"; of "house-belly," the African Mandingo's equivalent for "in the house"; and of "hair," often used for "leaf" or "feather" in many Melanesian languages.* In more modern forms of speech the process is suggested by such expressions as the *head* of a bridge, the *eye* of a needle, the *mouth* of a river, the *neck* of an estuary, the *trunk* and *arms* of a tree, the *lungs* of a bellows, the *bones* of an umbrella, the *nose* of a promontory, the *ears* of a book, the *fingers* of a clock, the *legs* of a table, the *veins* of marble, the *foot* of a mountain. Then there are analogies based on the activities of the human body, for when we describe things as standing, sitting, or lying; as rising, falling, running, or climbing—when we use expressions like "striking clock," "dancing light," "sleeping lake," "yawning precipice," "laughing skies," "babbling brooks," "raging billows," we are applying to the objects named terms originally used to describe our own acts. The sense of hearing, again, is utilized in such expressions as *taube Nuss* ("with nothing in the shell") and *taube Kohlen* ("those which have burned out"). So the defect of blindness is objectified in the *cæcum vallum* of Roman speech, in *ciego*, said in Spanish of cheese that "has no eyes," and in the *blinder Schuss* of the Germans, whose more familiar *Augenblick* everybody recalls. Not less suggestive are the numerous expressions which project conceptions of life and death into the environment, such as the *caput mortuum* (*tête morte*) of chemistry, *eau vive* (*Quellwasser*), "dead water" (turn of the tide), *todte Farbe* and *lebhafte Farbe*, *vivus lapis* (firestone), "quicksand" and "quicksilver," the "dead of night," "dead weight," a "dead level," and *todtes Kapital.* Nor must we forget that the reading of vitality into inorganic objects, common enough among savages, has by no means disappeared from civilized races. Dr. Stanley Hall's inquiries have shown that out of forty-eight children just attaining school age, twenty believed the moon and stars to be alive, fifteen thought a doll and sixteen thought flowers would suffer pain if burned. One pupil described the crescent moon as "half stuck" or "half buttoned" into the sky; the spluttering of coals in a fire was called "barking" by a girl four years and a half old. Miss Ingelow says that when over two years old, and for about a year after, she had the habit of attributing intelligence not only to all living creatures, but even to stones and manufactured articles.

This projection of words originally descriptive of the human body

* Codrington. The Melanesian Languages.

or of its activities into the objective world of Nature finds its richest illustrations in poetry,* where it may be held to represent less the elaborate artifice of a cultured mind than one of the most primitive tendencies of that mind powerfully swayed by emotion. Yet the process belongs equally to the more prosaic efforts which man puts forth to utilize the objects of his environment in the interests of self-maintenance. One of the earliest of these is seen in the use of words describing parts of the body to facilitate the description of the external world in its numerical aspects. Thus the Chinese use for "two" certain syllables (*ny* and *ceul*) which originally mean "ears," the Hottentots employing the word for "hand" in the same sense. In middle high German the word for "sheaf" (*Schock*) signifies sixty, and is applied in that sense to all kinds of objects. The Letts, owing to their habit of throwing fish three at a time, employ the word *mettens*, "a throw," in the sense of "three." Among the same people flounders are tied in lots of thirty, whence has arisen the practice of designating thirty by the word *kahlis*, meaning "cord." The Quichuas attach the significance of ten to the word *chuncu*, "heap." The Gallas word for "half" has been traced to the verb *chaba*, "to break," and is the equivalent of our own word "fraction." So in a large number of languages the term for hand signifies "five," "two hands" meaning ten, and "man" ("two hands and two feet") twenty.

A like origin must be claimed for the measures of space and weight needed by man in his industrial and commercial activities. The finger, the thumb, the hand, the palm, the forearm, the foot—the extended arms, as in the ancient *orgya*, and the extended legs, as in the modern yard—have all played a fundamental part in determining the standard measures of the civilized world. To the same class belong the γυη, the extent of field that could be worked by a laborer in one day; the *stade*, the distance which a good runner could traverse without stopping to take rest; also measures of time, such as the old division of the day based on the length of a man's shadow.

The human body was thus of primary importance as a means of comprehending and coming into relations with the external world. But men also sought to make the environment intelligible to them by projecting into it the images gained from the more general aspects of their life. Such phrases as "pig of iron," "monkey wrench," "battering ram," "lifting crane," remind us of a period in which objects were actually shaped so as to enable the mind to accommodate itself more completely to the thought of their vitality. The Greek sailing vessel, for example, was so constructed—with the body of a bird, with cheeks, eyes, and projecting ears—as to make it seem to

* See Henle. Poetische Personification.

the navigators of the time as almost alive. And the dolphins, eagles, ravens, and dragons which threatened England from the prows of the invading Danish fleet have had their prototypes in almost every nation that has betaken itself to the sea.

Not less suggestive are the more general aspects of the process. Our ancestor called the earth's satellite the "moon," or "measurer," because it served him as a divider of time. The familiar grains of wheat and barley which he harvested became the units of his measures. So the names of his seasons were based on the fall of the leaves, the reappearance of particular stars, or the periodical inundations upon which he depended for his food. The most primitive method in chronology is that which enables man to orient himself in the world of time by associating particular lunations with vicissitudes of weather, with seasonal aspects of vegetation, and with the constantly changing sights and sounds of the animal world. In the calendar of the Crees,* for example, we find such designations as "duck-month," "frog-moon," "leaf-moon," "berries-ripe-month," "buffalo-rutting moon," "leaves-entirely-changed," "leaves-in-the-trees," "fish-catching-moon," "moon-that-strikes-the-earth cold," "coldest-moon," "ice-thawing-moon," "eagles-seen-moon." So in the calendars of Central America and Mexico,† the months are named variously after the arrival of birds, the blossoming of flowers, the blowing of winds, the return of mosquitoes, and the appearance of fishes. The Greeks constantly used the movements of birds to mark the seasons; the arrival of the swallow and kite were thus noted. Hesiod tells us how the cry of the crane signaled the departure of winter, while the setting of the Pleiades gave notice to the plowman when to begin his work. The Incas ‡ called Venus "the hairy," on account of the brightness of her rays, just as the Peruvians named her the "eight-hour torch," or "the twilight lamp," from the time of her shining. One at least of the three portions into which the Greeks divided their night received its name—*περὶ λυχνων ἁφάς*—from the social custom of lighting the lamps at dusk. For whole races the departure of the sun made night a time of danger, and man did his best to lessen the mystery of the heavens by filling their obscure depths with the figures of animals and heroes, or by likening their shining lines of cosmic cloud to a road or highway for the march of beings celestial and terrestrial. Thus, for the speakers of Sanskrit the Milky Way was "The Path of the Gods"; the Lithuanians dubbed it "The Bird Road"; in Low German it is known as "The

* Contributions to the Ethnology and Philology of the Indian Tribes of the Missouri Valley. Dr. F. V. Hayden, 1862.

† The Native Calendars of Central America and Mexico. Daniel G. Brinton.

‡ Popular Science Monthly, vol. xlv, article Astronomy of the Incas.

Way of Cows"; the Cymris associated it with the course of the wind; for Scandinavians it was "The Road of Winter"; the Persians viewed it as the route along which the straw carrier drew his burden; to this day the Winnebagoes call it "The Way of the Chiefs." *

Science itself is indebted to terms and phrases in which outer realities are assimilated to the circumstances of the life lived by man and by the societies which he forms. Such words as "attraction," "repulsion," "resistance," "nature," "body," "atom," "current," contain obviously anthropomorphic elements. The human origin of the idea conveyed by the term "inertia" may be more or less veiled by unfamiliar Latin elements, yet it is recovered for us again in *Trägheit*, "idleness," the German form of the word. The phrase "natural selection" contains a teleological element which has more than once been used to throw discredit on the process which it describes. And when one observes how persistently such an anthropopathic expression as "affinity" is still applied to chemical reaction, or with what *naïveté* the term "law" is transferred from the realm of human jurisprudence into the domain of natural processes, one ceases to wonder at the constant confusions of outer with inner in which so much of the psychomorphism of the time has had its origin.

It would be strange, then, if, seen in so many of man's efforts to interpret the inanimate things around him, this process of self-projection should not also be valid for the larger relations of his mental activity to the universe. It is but a step, in fact, from the application of anthropomorphic words to the objects and processes of Nature, to the employment regarding such processes of anthropomorphic thought. As the child finds the satisfaction of its fancy in the discovery of some strange face as suggested to him in the decorations of the wall paper which surrounds his sick-bed, or in tracing out from the contours of clothes hung up within range of his vision the preposterous outline or figure of some human likeness or caricature, so the savage, with a deeper purpose born of necessity, traces out from the larger patterns of the moving world about him the organic shapes, embodying will and personality, that are to serve him as explanations of the external power which touches his existence for good or for evil, and which, thus serving him, enable him to come into relations with that power. It is the deepest interests of human life which make this process necessary, and it is of the very nature of the process that the characters thus projected into the environment must always—throughout the history of human ascent, and at every particular stage of it—be closely and definitely correlated with the degree and kind of the self-knowledge which is its source.

* Les Origines Indo-Européennes. Pictet, p. 568.

The earliest of the animal characters displaying this correlation, and used as a means of understanding the environment, could not well have been other than that of motion. That by the higher mammals, at any rate, moving things, even when inorganic, are generally regarded as alive, is a view rendered probable by a large body of evidence.* But when man finally appeared on the scene, a new element came in to complicate the merely animal attitude in which vitality was attributed to inanimate objects in motion. By contemplating the phenomena of his subjective life, and observing analogous phenomena in his fellow-beings—through the consideration of dreams, swoons, even death itself—our ancestor discovered in himself a character deeper than that of vitality; came to recognize that the living creature, animal and human, possesses an inner principle or essence underlying its activities; is not only "alive," but also "animated." At first the conception of vitality was one with the conception of bodily activity; at last man learned to differentiate the movements of the body from an inner essence to which he believed them to be due—learned, in a word, to distinguish between the corporeal existence and the soul. And having effected this first rude division of the characters of soul from the merely physical attributes of life, our ancestor soon projected the new view which he had reached of himself into the objects of his environment. The beneficent influences of Nature, so necessary to his life, he now invested with the good purposes of the better nature within him; in the maleficent forces of the cosmos he read the malignant will of his own angry passions.

But it is not as mere phenomena that these powers, thus finally ensouled and regarded as personal, can be thought about. In the beginning the human mind carries on its mental processes largely with the aid of images—recovered images of something seen, heard, felt, or tasted—and is yet far off from the stage of scientific thought in which abstract concepts take the place of the recovered mental pictures which have been yielded through the senses. Man thus needed concrete images with which to think about the personal powers of the external world, and he naturally found them in the animal and human shapes already familiar to him. Discovering some likeness between a Nature force and some animal, he henceforth associated the two, and recalled the image of the animal as the more concrete means of mental recovery when he wished to think of the abstract Nature power. Or, associating some departed ancestor, relative, hero, or king with the Nature force—an association which would be greatly strengthened by belief in the survival of the soul after death—

* See a paper by G. K. Schneider in vol. ii of Vierteljahrsschrift für wissenschaftliche Philosophie.

he gradually confounded the disembodied human power with the soul of the Nature power, and through the law of least effort, used the concrete image of the departed human being to stand in his mental processes for the much more difficult thought of the Nature force. But, whatever the process, animal shapes were obviously needed to reduce the Nature powers to such a degree of concreteness as would make it possible for primitive man to deal with them as objects of thought. And it is not less certain that while, for some races, the earliest shapes thus utilized were those of the lower animals, the final form for all races was that of man himself.

In the anthropomorphic stage, then, there is the same effort to understand the external system by assimilating it to something with which man is already familiar. The worshiped deities may be many or few, numberless as the Nature forces, polytheistic as among the Greeks and Romans, or one as in the monotheism of the Semite. Man likens them to himself, attributes to them not only his outward shape, but also his failings and virtues, making his Pantheon resemble not only the social order, but also the political system under which he happens to live. It is the completeness of this assimilation which made anthropomorphism the most persistent aspect of man's intellectual growth the world has known. Yet the view could linger only as the possession of the intellectually slothful and immature. The inadequacy, the crudeness, of the conception in which Deity was imaged as a gigantic man gradually forced itself upon the attention of the more thoughtful. Increased mental activity, a better acquaintance with natural processes, brought the idea of a power above Nature rather than merely superior to man; and as the human mind passed from the conception of the superhuman to that of the supernatural—as, moreover, the thought of merely local gods gave way to the idea of gods not limited in their functions to particular areas—the anthropomorphic shapes naturally fell away from the powers they could no longer adequately represent.

Then other changes, strictly correlated with man's advancing knowledge of himself, ushered in the latest stage of his attitude toward the external system. For in the same mind which had been compelled to reject crude anthropomorphism, there had been growing the consciousness of man as something more than a mere compound of vitality, consciousness, and will—something more than a set of bodily and mental capacities essential to the work of self-maintenance—the thought that man was the sum of his higher, not of his lower qualities, that henceforth he must be measured by the activities which he carried on in the domain of pure thought. And this recognition of mental attributes as the most worthy, the most exalted characters of human personality, could not fail to impress itself upon the conception of deity already undergoing deanthropomorphization. More and more, therefore, in the higher mind of the race, the Divine Being, not only losing his former bodily form, but yielding even the grosser attributes of personality with which he has been invested, becomes for the thought of man a psychical being in the deepest sense of that term. Anthropomorphism, or man-likening, passes away, and in its place comes psychomorphism, or mind-likening.

Two aspects are thus recognizable in the mental interpretation of the environment: on the one hand an aspect which may be called causal, since it seeks the source of the power exerted by Nature forces and objects; on the other, an aspect which is obviously formal, its main significance being that it condenses, so to speak, groups of qualities into a single mental sign. The causal aspect yields, in howsoever simple or complex a form, a theory of the cosmos or of its parts; the formal aspect is no more than a means, ready at hand, in the visible bodies of animals and men for facilitating the use of that theory in processes of thought. Hence we may regard vitalism, animism, psychomorphism as so many stages of man's attitude toward the external system, corresponding with the degree of his power to apprehend the more abstract as distinguished from the more particular and superficial characters of things that come within the range of his knowledge. In the first, he explicitly recognizes vitality, the most obvious character of Nature force; in the second, subsuming vitalism, he raises the soul life to the place of honor; in the third, subsuming both vitalism and animism, he emphasizes in psychomorphism the highest human qualities which his mind enables him to recognize.

The passage from the idea of multiplicity to that of unity is itself an inseparable part of the total process. As at the beginning man reads vitality into the separate objects and forces of Nature, without any thought of their underlying unity, so he regards as discrete, unconnected, objectively unrelated, the multifarious souls with which, in his thought, these various powers of the environment have come to be animated. But in course of time, by an inner necessity of intellectual growth, relations come to be perceived between the forces of Nature, likenesses are recognized between the functions of spirits and deities—between the powers put forth and the results achieved. The result is a process of coalescence which, to describe it in the briefest way, first merges a large number of spirit-evolved gods into a smaller number of relatively independent divinities, forms these into pantheons of gods each subordinated to a superior, and finally unites all beings regarded as divine in the single, all-comprehending, omniscient and omnipotent Deity of monotheism.

In all this advance, moreover, we find that the process illustrated by the changing phases of man's mental attitude toward Nature also holds good of the multifarious acts by which, in what is known as religion, man has sought to realize that attitude in conduct. For, in seeking to adjust himself to the system of Power, man has been forced to conceive of his Pantheon in terms as well of his social arrangements as of the political system under which he happened to be living. The spirit world of a horde of savages could only reflect the indefiniteness and disunion of the nomads whose imagination it satisfied. But as the household made its appearance, as a definite social structure arose, and the straggling tribes began to be united into nations, the gods themselves took on the characters of an analogous transformation. The divine selfishness—the "*remota ab nostris rebus*"—long ago satirized by the poet Lucretius, obviously correlated with the attitude of man toward man, just as naturally gave way, with the growth of the social sympathies, to the thought of that more active concern in human affairs which is one of the salient characters of the later phases of monotheism. The original indifference of Deity toward ethical issues—a widespread feature of the earlier religious conceptions—could not but pass away with the moral stagnation of the ancient communities out of which it had arisen. So the comparatively new thought of a God definitely identified in his aims and activities with the cause of moral reform is no less obviously a result of the new attitude of man himself toward problems of social improvement; while the persistence with which, in human thought, morals remain associated with religion sufficiently illustrates the extent to which man's view of each has been determined by the self-knowledge which underlies his attitude toward both. Note also, finally, the manifest relation in which our human thought regarding mind and body has always stood toward conceptions of a world-soul, and then the dependence of man's view of the relation of God to the world upon the knowledge of his own planet and of its place in the universe. For as long as our ancestor held the old geocentric theory of the cosmos—regarded the heavens as a set of spheres revolving around a flat earth—the thought of a deity outside the world related to it as a mechanician might be to a cunningly devised piece of clockwork which he had brought into existence, was inevitable. But when the geographical discoveries of the fifteenth century co-operated with the revelations of Galilei to secure the final triumph of the Copernican over the Ptolemaic theory of the world-order, the ancient view of Deity as external to his creation gave place to the essentially modern conception of his immanence.

If now we attentively examine the progress above described, we shall find that the earliest attitude of the human mind toward the external system tends in the latest to repeat itself on a higher plane and with a richer content. Thus vitalism, by the process of unification and intensification, culminates in anthropomorphic monotheism, while animism, through the coalescence of objects and forces at first believed to be separately animated, finally develops into pantheism. These two lines of thought, moreover, tend themselves to converge, or, at any rate, to become interchangeable, since monotheism, by deanthropomorphizing itself, approximates to pantheism, as is well seen in the Christian theologies and ethical religions of the world; while pantheism, by emphasizing the characters of intelligence and will, is sometimes hardly to be distinguished from those modern forms of monotheism which teach the doctrine of immanence. The intellectual outcome of the whole movement, embodying the modern attitude in Nature philosophy, is thus no longer anthropomorphism, but psychomorphism, since it reads into the universe, not the characters which distinguish human beings from the lower animals, but the highest manifestation of the characters recognized to be common to both, namely, psychic characters—the characters, in a word, of mind. For the deepest reaches of human thought, the process of man-likening has thus given way to the process of mind-likening. On the subjective side of mental inquiry we get psychomorphic monotheism, or what may be called theological pantheism; while on the objective side we reach scientific pantheism, or monism. It is true that the psychomorphism of scientific monism is reached by a process different from that which has culminated in the mind-likening of theological pantheism. Yet in both cases there is the same projection of intelligence into the external system as a means of comprehending it. And as the intelligence of atoms implies their vitality, we really return in scientific monism to the vitalistic attitude of the primitive observer of Nature. The salient difference between the two views is this: that while early man subsumed under his concept of vitality only the rudest characters thereof, the terms in the mind of the monist connotes in all their richness the ideas associated with mind.

Enough has now been said to show the basis on which rests the whole superstructure of man's mental attitude toward the cosmos. Despite all uncertainties regarding the details of the process, we may be assured of its fundamental nature, and are thus compelled to recognize the dependence of the forms of man's mental attitude toward the universe upon his knowledge of himself. It is because his own actions have their source in a personal will that he refers external movements to will. He is conscious of his own acts, and the world around him can not be devoid of a like illumination. Does he himself plan? Nature must also be intelligent. And the highest qualities which he can discover in himself he reads unhesitatingly into the cosmos.

At first sight, then, knowledge may seem inextricably involved in the process here described. If man can not know the external system to which he must adapt himself save by assimilating it to himself—save by interpreting it on the basis of analogies which he discovers between his own body and its activities, and the world with its activities—are we not committed by our very nature as organisms to all the errors which that nature imposes upon us? If, in other words, every effort to view the universe as it is, independently of us, be rendered impossible by the very nature of the knowing process, with what chance of success shall we seek to eliminate those vitalistic and psychomorphic characters which seem to belong to that process as its very warp and woof? In reality our knowledge inflicts upon us no such dilemma. Man is the helpless "measure of the universe" only to the extent that his reasoning processes are undeveloped. That knowledge must always have a subjective element is undoubted, but that man must always mistake the subjective vesture with which things are clothed by the senses for the things themselves is an inference which the whole history of thought negatives. While his life remained simple, primitive man could regard appearances as realities without prejudicing the overplus of utility brought to him by his knowledge. Yet as his relation to the natural surroundings grew in complexity, the importance of the reasoning process, with its veto power over the deliverances of the senses, began to assert itself. At first accepted with little or no demur, these deliverances came more and more to be challenged in the interest of self-maintenance; and finally, by expansion of a germ possessed by the mind in the beginning, there was developed that way of dealing with the testimony of appearances which we call the objective method. The evidence previously accepted had been, though on the whole useful, in large measure misleading. For in appearances men saw and felt mainly what Nature was for them, and only to a minor degree what the external world was for and in itself. The great need of the investigator of Nature is to know what things are independently of man, in order to know how they act on one another, as a means of knowing how they will act on the human organism, and how that organism may react on them in the interest of its own life. The prejudice done by implicit reliance on sense testimony arose out of the fact that it presented objects as largely unrelated to each other—as so much being, rather than as so much doing, acting and interacting, determining and interdetermining. It became the function of reason to develop, out of the material furnished by the senses, a knowledge of the true nature of the system external to man and involving him in its scope which we call universe. In the carrying out of this function the analogical process has remained, but the analogies utilized, from being likenesses between what things seem to be to the senses, have more and more become analogies between propositions made regarding what things do, regarding how things act upon, are related to and determine each other.

Our knowledge of Nature, therefore, illustrates progress from a stage in which external objects are viewed as so much doing—from a stage in which they seem more or less isolated, more or less independent of each other—to a stage in which we know them as acting and interacting, and therefore, by virtue of this action and interaction, as interrelated and interdependent. It was because man had to begin with the thought of the world around him as a series of unconnected aspects that he fell into the error of regarding every object as containing within itself the powers which it put forth; it was by gradually progressing to the knowledge of the external system as a process that he discovered how inextricably the smallest "flower in the crannied wall" is linked to its vastest environment, and how dependent must be the mechanism of the molecule, as well as of the solar system, upon the whole universe Power which we call cosmos.

Thus also is it with man's method of interpreting the external world system. At first unable to fully perceive his own relation to that system, as part of his inability to perceive general cosmic relations, and therefore viewing himself as more or less independent of Nature—as something imposed upon it rather than as something arising out of it—he naturally sought to force it for purposes of explanation into the narrow limits of his knowledge of himself, of his feelings, his thoughts, his institutions. But as he grew in the power to comprehend his place in the system of things—to understand the way in which the objects and forces of the world were related to each other, together with the way in which he, as knowing organism, was related to the universe—he gradually ceased from his vain striving to subject the cosmos to himself, and at last learned not only to subordinate himself to the cosmos, but to trace to it unreservedly the whole method and meaning of his origin as a living, thinking organism. Man in the beginning could be no more than the measure of the universe. That he has come at last, wielding the objective method, to be its measurer, is the culmination of a struggle between false and true ways of interpreting Nature which has had the whole history of human thought for its arena, and for its final triumph the establishment of the objective or scientific method of investigation upon impregnable foundations.

FROM SERFDOM TO FREEDOM.

By EDWARD BICKNELL.

HOWEVER keen our interest in the problems arising out of the recent Spanish war, and however earnest our study of the policy to be pursued toward our new dependencies, we should not forget that the problems pressing for a solution before the war are still with us. The labor question, which then commanded so much of our thought, is still unsettled, and is by no means dwarfed by the subjects now upon every lip. Rather, as has been shown in an article in a recent number of this magazine, this question really forms one of the most important elements of the present situation, and should not be lost sight of in shaping public policy. We are entering upon an untilled field as far as our institutions are concerned, and we have the opportunity to start on a higher level in treating the relations of capital and labor in our new possessions, if we have the wisdom to know how, and the courage to do as well as we know.

It will help us in a consideration of the present status of the laborer and of his future if we study his past, beginning, if not with Adam, at least with the laborer's entrance into English history as a distinct class. Any one at all familiar with Green's Short History of the English People will see how much use I have made of that instructive and fascinating work. And if I tell only an old story, it may still be of value to many of us in recalling facts almost forgotten, and a help to others whose vision into the past is limited. Brushing away the cobwebs in the old attic of our father's house usually brings to light treasures the recollection of which had slipped from our minds.

The free laborer, the man who works for wages, for whom and where he chooses, did not exist as a class until within about six hundred years. In the early days the laborer was tied to the soil where he was born, Such a thing as a laborer going about to seek work where he would, or having much to say about his master or his wages, was usually out of the question.

At a very early day the towns or boroughs of England had preserved old rights, or regained them, which the rural part of England had lost, and in general serfage could not exist there as it did in the country round them. Trade and manufacture, such as they were in that day, did not make the demand for labor which was made by the agricultural pursuits of the country or in the castles of the nobility. So we do not find in the towns of the eleventh or twelfth century the large labor class we do to-day. In general we may fairly say that the labor class began in the country.

The manorial system had divided the rural part of England for cultivation and general order into large estates. The lord of the manor occupied a part of the estate for his own demesne and divided the rest among his villeins or serfs, who in return were obliged to render services to him. It is not necessary for my purpose to enter into any long description or discussion of the different relations existing between different tenants and their overlord, or the differences existing under Saxon or Norman rule. The general relation of lord of the manor and his tenants or villeins or serfs is the main point to be observed. The villeins or serfs of the manor cultivated the lord's home farm or demesne, filled his barn, cut his wood, and did all his work. "These services were the labor rent by which they held their lands." Some of these tenants, the villeins, were obliged to work on the lord's demesne at harvest only and to help plow and sow, while the others, the serfs, to speak in general terms, were obliged to help on the home farm or in the castle the year round.

In course of time the use of a certain parcel of land by the tenant and a right to pasturage and so forth on the one hand, and the amount and kind of service required on the other, became definitely regulated by custom; and instead of the use of the land being a mere indulgence given to the tenant to be taken away from him on any whim of his lord, it became a definite right in the land which must be respected and could be pleaded at law.

"The number of teams," and so forth, "the services that a lord could claim, at first mere matter of oral tradition, came to be entered on the court roll of the manor, a copy of which became the title deed of the villein." So after a while instead of "villein" he became a "copyholder."

As time went on it grew to be customary, instead of rendering services for the use of the land held by copyhold, to pay a money rent. In other words, the system of leasing the little farms came into use, and from that came the tenant farmer. This left the other laborers about the lord's demesne or his castle as before. While the class of villeins, who did only occasional services, although definite as to amount and time, gradually commuted these services into money payments, and became farmers, the other serfs still remained on the manor, liable to do their work when and where it was customary. This rise of the wealthier tenants made a new class between the large proprietors, the lords of the manor, and the tenants or serfs still bound by custom to work for their lords. But the same process which freed the farmer from personal service in time became the chief way of freeing the serf also. Until this came about the serf or laborer, whatever other rights he might have, and he was not a slave, was born to his holding and his lord. He could choose neither master nor place of work. "He paid head money for license to remove from the estate in search of trade or hire, and a refusal to return on recall by his owner would have ended in his pursuit as a fugitive outlaw." But the advance of society silently worked to free the laborer from this local bondage. The runaway serf gained freedom by residence in a chartered town for a year and a day. The influence of the church was directed toward his emancipation, at least on all estates outside of its own, but the main cause was the growing tendency to commute labor services for money payments. As Mr. Green says: "The luxury of the castle hall, the splendor and pomp of chivalry, the cost of campaigns, drained the purses of knight and baron, and the sale of freedom to a serf or exemption from services to a villein afforded an easy and tempting mode of refilling them. In this process even kings took part. Edward III sent commissioners to royal estates for the especial purpose of selling manumissions to the king's serfs, and we still possess the names of those who were enfranchised with their families by a payment of hard cash in aid of the exhausted exchequer." The Crusades, whatever else they may have accomplished, aided in this freedom for the serf. Those costly expeditions dissipated the estates of the barons, and, to use Hume's somewhat strained expression, "Their poverty extorted from their pride those charters of freedom which unlocked the fetters of the slave." And so, following the rise of the farmer, came this new class—the free laborer. By the latter part of the fourteenth century labor was no longer, as a rule, "bound to one spot or one master; it was free to hire itself to what employer and to choose what field of employment it would."

This is the beginning of the labor class as we know it. In those times labor was abundant and therefore cheap. The landowners in the country and the craftsmen in the town found plenty of help, and the new class then coming upon the stage could go where it was needed. From a serf the common laborer had become his own master as far as choosing his own employer and the place of his employment. But just at this time a condition of affairs arose which put an end to this state of things. In 1348 came the Great Plague. That swept away more than half of the three or four millions who then made up the population of England. The plague and the sudden rise of wages which followed, although coupled with an increase in the cost of living, quite naturally brought on an outburst of lawless self-indulgence which told especially upon the laborer looking for work. He easily became the "sturdy beggar" or "bandit of the woods." While harvests rotted to the ground from lack of hands, in the towns labor was just as scarce and equally as independent. The landowners and wealthier craftsmen were startled and terrified by "what seemed in their age the extravagant demands of the new labor classes."

Here we have the labor problem at once and at the beginning. And from that time to this that problem has been with us. With the capitalist one person and the laborer another there has been always more or less discord. As Richard T. Ely has somewhere said, although in theory capital and labor should be allies and not enemies, the interests of those furnishing capital or labor are not precisely identical. But five hundred years ago the labor class of to-day had just come into existence. It had no organization then, and its members few political rights. The landowners and craftsmen could appeal effectively to the crown and Parliament through their wealth, their political power, and the craftsmen, especially, through their organizations. The laborer had only himself and brute force. As a result, the legislation of that day reflects the demands of the upper and middle classes only. The laboring class was considered only as it affected the landowners and craftsmen. So the labor troubles of that day were met with the Statute of Laborers. "Every man or woman," runs this famous provision, "of whatsoever condition, free or bond, able in body, and within the age of threescore years, . . . and not having of his own about the tillage of which he may occupy himself, and not serving any other, shall be bound to serve the employer who shall require him to do so, and shall take only the wages which were accustomed to be taken in the neighborhood where he is bound to serve" two years before the plague began. A refusal to obey was punished by imprisonment. Here was an attempt to fix the rate of wages by statute, and to fix them very much lower than a fair market rate; and, further, to force the unemployed laborer to serve any man who first demanded it. The statute failed in its object, naturally, and so sterner measures were adopted. "Not only was the price of labor fixed by Parliament in the next statute of 1351, but the labor class was once more tied to the soil." It was made the servant not of one master but of a class—the employers. "The laborer was forbidden to quit the parish where he lived in search of better-paid employment; if he disobeyed, he became a 'fugitive,' and subject to imprisonment at the hands of the justices of the peace." Provisions had risen so that a day's work at the legal wages would not purchase enough for a man's support, and therefore no such law could be enforced literally. Still, the landowners persisted in trying, and at last the runaway laborer, the man looking for better wages, was branded on the forehead with a hot iron, while the harboring of serfs in towns was rigorously put down. As the landowners wanted all the labor they could get, the commutation of labor service for money payments ceased, and every effort was made and every quibble taken advantage of to annul manumissions previously made. In the towns, under the pressure of the craftsmen, the system of forced labor was applied with even more rigor than in the country, and strikes and combinations became frequent.

That is the state of things in free England at a time when labor was not strong enough to protect itself—called upon by the law of the land to work for less than living wages or be branded as cattle! The irrepressible conflict between capital and labor began with the very beginning of the existence of the labor class.

In such a condition of things as here indicated, is it any wonder that there were labor disturbances in those days—that there was a peasant revolt? Already the doctrine of the equality of man and social inequality was being preached to the lower classes. In 1360 John Ball—"a mad priest in Kent," as Froissart calls him—preached such a communistic sermon as this to the sturdy yeomen of that day: "Good people, things will never go well in England so long as goods be not in common, and so long as there be villeins and gentlemen. By what right are they whom we call lords greater folk than we? On what grounds have they deserved it? Why do they hold us in serfage? If we all came of the same father and mother, of Adam and Eve, how can they say or prove that they are better than we, if it be not that they make us gain for them by our toil what they spend in their pride? They are clothed in velvet, and warm in their furs and their ermines, while we are covered with rags. They have wine and spices and fair bread; and we oatcake and straw, and water to drink. They have leisure and fine houses; we have pain and labor, the rain and wind in the fields. And yet it is of us and of our toil that these men hold their state." That is the same cry against the inequality of property and social condition which we hear to-day. And we may thank him, and men like him and with his inspiration, that the conditions of five hundred years ago have changed, and that the dawn of a better and higher humanity has broken upon us. Filled with socialism and communism as the words are, they still have a truth which appeals to every sympathetic and thoughtful man.

And it was in those early days that the old rhyme was heard all over the land:

"When Adam delved and Eve span,
Who was then the gentleman?"

The sermon was preached against the tyranny of property, the rhyme was full of the democracy of the coming years.

I do not imagine that the instigators of such laws as the Statute of Laborers were hard men as men go. They could see only their side of the case. The laborer had become a necessity for them, and they rather believed that the Almighty had put him on earth for their advantage. I am afraid that something of that spirit still is left among us. The feeling still exists that the employer and capitalist can take care of and provide for the employees better than they can themselves; that they should be very thankful when out of his abundance the employer builds them a library or permits them to live in some finely ordered village as he directs. But somehow the feeling is growing now that if the wage-earner had a larger and fairer share in the profits he could take care of himself better in the end and grow faster, because he would be more his own master; and that the good things now and then given him with more or less ostentation as gifts are bought with the money he really ought to have and in the future hopes to have himself.

Well, the result of such laws and the general social discontent and the levy of new taxes upon even the lower classes brought about the Peasant Revolt in 1381. Of course, the power of the upper classes, aided by the courage of Richard II, then only a boy, put down the revolt, but not until the king had promised amnesty and emancipation to the serfs. Death on the scaffold and in the field soon showed the participants how little such promises were worth. The serfs were subdued, but strife between the laborers and employers was not ended. The legislation still reflects the terror and greed of the landowners, for, in spite of all, labor was in demand and had the market at its feet. Legislation forbade "the child of any tiller of the soil to be apprenticed in a town," and the landowners "prayed Richard to ordain 'that no bondman or bondwoman shall place their children at school, as has been done, so as to advance their children in the world by their going into the church.'" But villeinage continued to disappear, and within the next hundred and fifty years it had become "an antiquated thing." The failure of the landowners to again fasten labor to the soil and to fix low wages drove their energies in a new direction. "Sheep farming required fewer hands than tillage, and the scarcity and high price of labor tended to throw more and more land into sheep farms." As personal service died away it became the interest of the lord to unite the small holdings on his estate into larger ones. The evictions consequent upon this course threw many laborers upon the market, and the sheep farms diminished the number required, while the smaller amount of holdings devoted to agriculture increased the price of food. And so it is not surprising that within the course of a comparatively few years, instead of a scarcity there was a glut of labor; that pauperism increased, and social discontent continued; that vagabondage with its dangers to society at large became a difficult problem. Indeed, the poor have always been with us, but those of us who find so much to depress us in these modern days can get new courage by looking back to those old days and can see the real progress which has been made. The whole lower class in England down to the time of Elizabeth stood looking into the face of want. Henry

VIII confiscated the monasteries, but put nothing in their place, and in a measure by so doing deprived the poor of some relief from the wealth of the church. But Elizabeth inaugurated a system of poor-laws which, although crude and somewhat hard, still served to ward off some of the social danger. The course of events, however, and the rise of new industries did more to make life for the laborer, the landless man, less bitter. With the discovery of America and the opening of fisheries in these western waters, and the adventurous and buccaneering voyages of Drake and his compeers, came the gradual development of manufacture, and a "more careful and constant cultivation of the land." All these were new and larger avenues for the employment of labor. By this time the laborer had grown entirely away from serfage, had been freed from the terrible grasp of a hopeless future, and the possibility of a degree of comfort and independence had come into existence. We need not linger longer over his early days. The laborer still had his peculiar trials and hardships, but he had a future. From a subject class, the terror as well as necessity of its employers, he has grown to be their equal before the law, and this by his own efforts, aided, of course, by the advance of society and the broader humanity of mankind.

The increase of manufacture brought with it a new danger to the working class as we reach our times, and brought about a state of things which gave rise to trades unions. Manufacture naturally in the beginning was carried on in a small way, but in modern times, especially as we get into this century, the small concerns grew into large ones. Instead of one man or partnership with a comparatively small amount of capital, the corporation or joint-stock company with its large aggregation of capital carries on the business of manufacture and trade. This aggregation of capital has made an entire change in the relation between employer and employee. The corporation came in the line of progress. Consolidation of capital has come to stay, and properly so, but it brought with it dangers, just as every step in advance has done. It was to meet the new dangers to the wage-earners that trades unions came into being, for trades unions and labor unions are really only organizations of labor as corporations are aggregations of capital.

When industrial establishments were small, the owner, whether in trade or manufacture, had practically absolute direction of his business. In the industrial world what corresponds to an unlimited monarchy in the political world has been the system. As establishments grew larger, the autocratic power of the owner passed to the manager acting for the owners. As one writer puts it: "Huge industrial establishments are under the unrestrained control of a single man. At his will they are set in motion; at his will they stand still;

at his will capital and labor unite and are fruitful; at his will they are parted and remain barren. Men come and go at his bidding. He knows no superior and recognizes no limitations. He calls an attempt at control 'dictation,' and resents it with anger." That is the extreme case, and is industrial despotism. While the results doubtless are good in many cases, and the laborer receives fair and decent treatment in most cases, that is owing to the temperament or prudence and good judgment of the master and not to the system. Such a condition of things is becoming more and more modified. We have reached in many cases a condition which may be said to correspond to a monarchy with constitutional limitations—the master is restrained in the exercise of his power by public opinion, the strength of the workingmen, and in some cases by legal limitations. The organization of boards of arbitration, and the recognition of the right of the employee to a share in the profits, are daily extending. The tendency toward giving the wage-earners a share in the business, some modified form of co-operation, is daily extending. The trend is toward what may be called industrial democracy, just as in the political world real democracy is fast becoming the universal principle, whatever the style of the government may be.

This advance in the industrial world has come about through the agitation and power of labor organizations, of which, as they exist now, trades unions were the early manifestation. The employer, as a rule, looked after his own interests mainly, and the employee alone by himself had to take what he could get and do as he was told. Just as the people, after they sunk into subjection in the earlier days, had little political power as against the nobility until they were strong enough to take it, so the laborer still would be of little account except as a more or less intelligent machine unless he had proved himself a man, with a man's aspirations and a man's energy.

Labor organizations or trades unions came into existence in England. The democratic spirit, the spirit of liberty, the Saxon spirit of independence, which wrested from kings and the nobility all the rights which the common people enjoy, has been doing in the industrial world only what it did in the political world years before.

We may say that trades unions find their prototype in the *frith guilds* or *peace guilds* of the Anglo-Saxon. A few words in general about them and their successors and the spirit pervading them, the causes of their existence and decay, will have a bearing on labor organizations, which are like them in "being founded on similar mental faculties and desires and as contemplating similar purposes."

These *frith guilds* seem to have been associations of neighbors for mutual help and protection. They replaced the older brotherhood of kinsfolk, which had existed among the German races, "by a voluntary association of neighbors for the same purposes of order and self-defense." An isolated existence for a man, even a freeman, was one of danger, especially when the feudal temper of the nobles increased and the Danish incursions broke over England. The ties of kindred had become weakened, and the frith guild took the place of the family. A mutual oath bound the members together, and the monthly guild feast became the substitute for the old gathering round the family hearth. A member could call upon the guild in case of violence or wrong; when charged with crime, the guild answered for him, and when guilty, punished him; when poor, it supported him; and when dead, buried him. When these guilds were located in towns rather than in the country, they inevitably tended in time to combine, and eventually the town passed from a collection of guilds into one large guild, and we have the *town guild*. The word "town" is used in contradistinction from the word "country," just as we say "town and country," "going to town," and so on. The spirit of independence and freedom, kept alive in our town meetings here, and in our local self-government, has come down to us through those old town guilds and the boroughs of England. It is to the towns of England and not to the country that we owe much of our liberty to-day.

So these guilds in towns, by joining together and making a town guild, became quite strong communities. They made demands upon the crown itself, and took upon themselves the government of the towns where they were located. Their members were the landowners of the town, and the other people who came there to settle, no matter how numerous, had no part in the government. From being democratic in the beginning, as the frith guilds were, the towns became oligarchies.

In the course of time the differences between town and country became more marked. The town guilds began to have less and less to do with agriculture, although at first they were interested in it. The wealth in the town is turned to trade and manufacture, such as there was in those days. So, by the time of the Norman conquest, in 1066, we hear little of town guilds, but in almost every case *merchant guilds*. The *town guild* has become a *merchant guild*, although composed of the same constituency. The commercial spirit has become the ruling spirit of the town.

As time went on and life and property became safer and trade increased, the consequent accumulation of wealth in towns produced important results in the character of these municipal institutions. "In becoming a merchant guild the body of citizens who formed" the government of "the town enlarged their powers of civic legislation by applying them to the control of their internal trade." No longer confining themselves to providing for public order or protection from unjust oppression or dangers from without, they began to legislate for their own immediate advancement and for their own pockets. "It became their especial business to obtain from the crown or from their lords wider commercial privileges, rights of coinage, grants of fairs, and exemptions from tolls; while within the town itself they framed regulations as to the sale and quality of goods, the control of markets, and the recovery of debts." And further, the members of the guild withdrew from the humbler trades to confine themselves to the larger business of commerce or trades requiring large capital, leaving the trades and traffic given up to their poorer neighbors. This ruling class comprised only a part of the inhabitants, only the members of the merchant guild. The great mass of the people, the artisans and the poor, the men without land, the serfs escaped from the country and gaining their freedom in the town, all had no voice in the government whatever. They lived and worked and earned their daily bread practically by permission or at least under the direct control of the merchant guild. From a simple association, the guilds in towns had become the governing body, and a government in the hands of a few at that. From the need of protection on account of individual weakness, the members of the guilds had grown to be in need of repression; and with the demand for repression came the instrument of repression—the *craft guild.* Against the autocratic power of the merchant guild arose the craft guilds, or associations of workers in the various trades, those trades abandoned by the merchants, and these guilds "soon rose into dangerous rivalry with the original merchant guild of the town."

These craft guilds in the old English towns, in order to attain their objects, considered it necessary to compel the whole body of craftsmen belonging to the trade to join the guild of that craft or trade; and further, that the guild should have legal control over the trade itself—who should be admitted to it, and so forth. "A royal charter was indispensable for these purposes, and over the grant of these charters took place the first struggle with the merchant guild, which had till then solely exercised jurisdiction over trade within the borough." The struggle was a fierce one and long continued, but the spread of the craft guilds went steadily on, and the control of trade passed into their hands. Then the next step—a share in the government of the borough itself—was taken, and the government of the towns passed from an oligarchy into the hands of the middle classes.

The craft guild came into being just as its predecessor had, from the necessity of association for protection, and like it was democratic at first; and, again like it, became in time an oligarchy as narrow as that which it had deposed. The craft guild arose because the artisans and tradesmen had grown to a position where they could recognize the injustice and oppression of the merchant guild, and were strong enough and persistent enough to assert themselves, and as long as the craft guilds were democratic in spirit and were true to the needs for which they were organized they flourished. But with age and success came narrowness and bigotry and opposition to progress. They became monopolies of employment and societies of greedy capitalists, and in England withered away before the growth of the modern vast industrial establishment.

I have ventured to give this general sketch of these guilds because the same spirit and necessities which inspired them brought the trades union into being. The trades union or labor organization was created to protect the laborer and gain for him a better position in life, to raise his standard of living. It is like the old guilds in being subject to the same dangers as they were, and when it proves false to its true objects it will pass away as did the old guilds. It will last only so long as there is a necessity for its existence, as long as it does the work it is born to do. And when it has come to deny freedom, to refuse another's rights, and to repress industry, the seeds of dissolution are already sown.

Trades unions or labor unions arose from the necessity of organization among the laborers or wage-earners if they were to hold their own against the aggregation of capital. The craft guild arose at a time when trading and manufacturing concerns were small, when the interest of both master and workman in a business were alike joined in opposition to the exactions of a superior class—the merchant guild; while the trades union came upon the field to protect the laborer against his employer. Whatever other objects and aims it may have had do not enter into my purposes in this paper. The personal relation which had existed between the master and servant, the employer and his few employees, the manufacturer and his half dozen workmen or apprentices, no longer existed when the workers became scores and hundreds, and the owner of the business was replaced by the manager or superintendent. That personal relation was in some measure a protection for both, but when that disappeared the temptation to gratify owners and stockholders with big dividends became too strong to be overcome. Against organized capital there was absolute need of organized labor, and trades unions and labor unions and such organizations came into existence.

There was no possibility of their existence until the laborer had become intellectually and socially capable of organization, and until the divine spirit of discontent drove him to association with his brother worker. During all the years from the time of his serfdom up to the time these organizations began he had been slowly growing in development and gaining something in political position, but it was not until political power came nearer and nearer to him that he gained the strength to raise his standard of living, to make a stand for himself. He knew the struggle would be a hard one, for everything he gained seemed to be something taken away from those who held themselves above him and better than he.

As a rule, we are very well content to let things alone if we ourselves are fairly comfortable, and especially are we blind to another's ills if the remedy for them is found in a renunciation of part of that which we have always considered our own. There is nothing particularly new in this. We easily can imagine some worthy burgher in the olden time expostulating at the demand of the craft guild even to be allowed to exist, and I do not imagine his language varied much in spirit from the indignant disgust shown by some large employer of labor to-day when he talks of labor unions. Doubtless these unions to-day seem to him to have the same dangerous tendencies which the craft guilds were talked of as having eight hundred years ago.

If there were no wrongs to right, if selfishness did not exist, if there were a real belief in the brotherhood of man, and life were in accordance with that belief, such organizations might not be necessary, or if they existed have other aims; but until all men have an equal chance for self-development, and a chance for something more than a mere existence, labor unions or something to take their place must exist.

And so we stand to-day with labor unions and the labor problem, so called, with us. The laboring class is discontented. Men claim as rights what their fathers would have been glad to get as favors. There are violence and bad blood and waste, and so there have been from the beginning. But there have been also injustice and oppression and greed from the beginning. While we may condemn strongly much of the violence and wrongdoing of labor organizations, we can find many extenuating circumstances. The same spirit of independence, the same desire for equal justice which animated the old guilds of England, and which have made the Englishman and those who have sprung from him the freest as well as most law-abiding people on the earth, are found within the organizations of labor. We in this country hardly can find only danger in the spirit which impels the workingman to resist every encroachment upon his rights, to strive for that better future to which he believes he is entitled. There were many things done in the youth of our history which in our manhood we regret, and I hardly think, as a nation, our own robe is so unspotted that we must draw it round us lest it be soiled by the violence of a perhaps uneducated and inadvisable but still earnest effort after higher and better conditions of life. Let us read and ponder over our histories anew, and with humble hearts try to find a better way both for the laborer and ourselves.

I have said that it was through his organization that the laborer has made the industrial and social advance he certainly has made in the last century. The trades unions, like the guilds before them, had to struggle for a legal existence, and their early days were full of violence. Dr. Brentano, in his work on Trades Unions, says: "They have fought contests quite as fierce as those of the old craftsmen against the patricians, if not fiercer. The history of their sufferings since the end of the eighteenth century, and of the privations endured for their independence, is a real record of heroism." May not we hope with him that now they may cease using the arms of violence which belong to former times and use the legal means which belong to our days?

We can not approve of their violence, but let us not be unduly alarmed by it. If society becomes so ossified in its usages and habits and thinking that a newer and better thought can not get in, a nobler way of living for all be entered upon, it sometimes seems as if in the very nature of things violence must come to rend away the obstructions. I believe that labor organizations are as much the instruments of progress as the town guilds and craft guilds of old. They will do their work, and the world will be the better for it. They tend to make society more democratic industrially as well as politically, as their predecessors did, and therefore better. For what is democracy but a practical recognition of the brotherhood of man? If Christianity amounts to anything, what higher aim should we have than that?

Many students of the problems involved state that in the long run labor still does not receive its full share of the profits; that in order to keep up the standard of living which the wage-earner already has reached he must have a larger reserve fund. In other words, he must be able to save more. To do that and still live as he claims he ought, his share in the profits, his wages, must be larger than now. We can not claim that the standard is too high because admittedly it is higher than ever before. Hon. Carroll D. Wright, in a recent address, says: "Under the iron law of wages as announced by Ricardo, it [the labor question] is a struggle simply to secure barely enough of food and raiment and shelter to preserve the working physical machine, the rule being that wages ought not to be paid over the bare necessities. To-day the standard of living of the ordinary wage receiver involves margins above the iron law of from ten to fifteen per cent, out of which margin is to be found what are now called spiritual necessities, means of leisure, reading, music, recreation, etc., so that the demand of the worker in all civilized countries is for the expansion of this margin. He feels entitled to this because society has insisted upon educating him, giving him a taste for higher things, making him a social and political factor; in fact, fitting him for membership in a democratic community."

Labor organizations, in spite of much extravagant language and many ill-advised acts, certainly aim at a better condition for the wage-earner. We fail to see the intelligence underlying industrial controversies because progress has been so rapid. Some of the methods of labor organizations are violent and the weapons used are in a great measure strikes and boycotts. That is industrial warfare and is as costly and wasteful and cruel in many ways as any warfare is, but very often these organizations seem to have no other method of making their power felt; no other way of bringing about a needed reform. And we can not say that all strikes have been or are necessarily wrong, except in the same way that all warfare is an evil. The very readiness to strike will effect a reform which a known weakness or lack of courage on the part of the organization would have prevented. Such an authority as John Stuart Mill says that "strikes, therefore, and the trade societies which render strikes possible, are for these various reasons not a mischievous, but, on the contrary, a valuable part of the existing machinery of society." Whether in a particular case a strike or boycott is right or wrong depends upon the facts of that case, and whether we have reached a point where strikes are no longer right, no matter what may have been the case in the past, is another question. Let us hope we are nearer that time, at any rate. It will depend upon the attitude of employers as well as employees.

Out of strikes themselves comes a remedy. Daniel J. Ryan, in his article on Arbitration, records that "for sixteen years the disputes of labor and capital in the rolling mills of England have been settled by arbitration, and it has been an era remarkably free from strikes. The Board of Arbitration for the north of England iron business was, as all efforts of this kind usually are, the outgrowth of a strike." Now, in this part of England before the formation of this board, strikes were chronic. The works in that section recently had 1,913 puddling furnaces—more than in all Pennsylvania, and half as many as in the entire United States.

The limits of this article will not allow a discussion of voluntary or involuntary arbitration, but let me say that in the above case we see that a simple arrangement between the parties changed all the strife to peace. Will society long tolerate a continuance of industrial warfare when it has in its own hands a preventive? For its own protection will it not tell employer and laborer, "You must settle your differences quietly by mutual agreement, or, if you can not, I will settle them for you"? It says this now to the individual. Men and women are not allowed in these days to settle their rights and wrongs by brute force. That method passed away long years ago in civilized communities. And society must continue to suffer from the violence and waste of strikes until it teaches employers and workingmen and itself a higher and better way.

May not it be possible that the outcome will be that associations of wage-earners are to be treated as the equals of the employer? Will not the democratic spirit of the age to come so permeate the industrial as well as the political world that the laborer and the employer will each have a share in the business they together carry on?

I have tried to make a very broad sketch of the change which has taken place in the condition of the laborer, with a consideration of some of the means by which that has come about. No longer is he a serf—no longer even the servant of a ruling class. He at length has risen to a share in the government of his town and country. No longer are laws passed against him specially, but in his favor. The laborer has become free—free to follow along the path of his predecessors, to gain full justice, but not to oppress others. Before the law at least he is the equal of his employer. I have implied at least that he has but followed the spirit which led his older brother of the middle class up from practical subjection to power. The craft guilds of the one, the labor unions of the other, are in the same line as the old town guilds. They all are manifestations of that democratic independence which seems necessary for political freedom. They all imply the capacity for organization as they all have shown its power. Let us believe that, like the old guilds, these labor organizations are helpful parts of the machinery of human progress. They force upon us the fact that there have been and are injustices which must be righted. We are beginning to learn that we can not depend upon one side alone for our political economy or our facts; that we need an organization strong enough to compel respect in order to protect those who without it would be, as they have been, helpless.

All the smoke and clash of industrial warfare seem terrifying; the innocent victims shock our sense of justice, but it is leading to the perfect peace. The true democracy—the brotherhood of man—is forcing itself upon mankind. If we in our prejudice, our selfishness, our ignorance, defy the signs of its coming, try to prevent its growth, or find only license in liberty, we shall continue to suffer all the ills which an obstruction of progress or a violation of its laws always brings with it. Is it not true that never in the history of the world has there been an agrarian rising, a peasant revolt, a labor war, that back of it we do not find as a main cause the injustice, the oppression, the selfishness of a more powerful class? And will there be perfect peace, perfect prosperity, until the divine harmony—the real brotherhood of man—is the rule of life? Wrong always breeds violence. But out of that violence, when the wrong is made right, comes peace.

Massachusetts in her motto declares that "by the sword she seeks peace," and, to use Richard T. Ely's words, "the Prince of Peace proclaimed, 'Think not that I am come to send peace on earth; I came not to send peace, but a sword'; and yet truly was he called the Prince of Peace." Often is war the price of peace. And no one, no class of men, deserve their freedom unless, when all other means fail, they have the courage and energy to pay the price.

Therefore, we will not be alarmed at struggles which in the end will bring about a better condition of life for all. Rather let us try to end those struggles by pushing bravely on toward the end mankind is striving for. We, with such a past as ours, must not be false to the ideal which is our birthright; we should not be incapable of finding the true way. If we will forget our merely partisan strife, our petty jealousies, our class distinctions, and have only one aim, justice for all, an equal chance for self-development for all, whether he be born rich or poor, the ruling spirit of the next century will keep America still true to her high calling, and mankind still will find in her the inspiration to raise the disheartened and lowly of other lands. The truest patriotism is broad enough to help the unfortunate everywhere, and with courage, intelligence, and a faith in true democracy we shall not fail.

THE BERING SEA CONTROVERSY ONCE MORE.

By Prof. T. C. MENDENHALL.

MR. CLARK'S interesting and, on the whole, fair review of my article on Expert Testimony in the Bering Sea Controversy, printed in this journal in 1897, might be allowed to stand, without comment, as the best possible vindication of the work of the Bering Sea Commission of 1891–'92, and as strong corroborative evidence of the soundness of the position taken in the article referred to. One or two quotations which he makes, however, are placed in such relation to other parts of the paper as to imply meanings which a reading of the article as a whole will show were never intended. This is notably true of the description of the frame of mind in which a scientific man should approach or conduct any investigation, which Mr. Clark quotes, and the further statement that, unfortunately, he often fails to come up to the standard set, and especially when his own interests are involved.

It might easily be inferred that these remarks were meant to have special application to the members of one or both Bering Sea commissions, while as a matter of fact they were a part of the general introduction, occurring some time before any reference is made to the commissions. I should greatly regret having any one understand that there was the slightest intimation of the existence of a "handsome retainer," or anything of the sort, in connection with any or all of the Bering Sea investigations.

As far as the American representatives on the first commission are concerned, it is no harm to say that the pecuniary residual was unfortunately affected by the wrong sign, and this was doubtless the case as well with Dr. Jordan and his colleagues.

As to the truth of the statement regarding the "scientific expert," no evidence need be offered here, for it is furnishd by every court in the land, and not a day passes that does not witness a struggle between "experts" who have nearly always started from the same premises, but whose conclusions are diametrically opposed to each other. What I do want to say is that this is quite consistent with the perfect honesty and good intent of the experts themselves. It is the result of the limitations to which the operations of the human intellect are still subjected, and it is a fact always to be reckoned with in matters of this kind. There should be no skepticism as to the honesty and frankness of Sir George Baden-Powell and Dr. George M. Dawson in assuming an attitude so opposed to that of the American commissioners in 1892.

Mr. Clark regards my article of 1897 as a "prediction of failure for the new commission," an assumption quite unjustified and unsustained by the article itself, in which the fullest recognition is shown of the great value of the work of Dr. Jordan and his colleagues. Indeed, the article was purposely prepared and published before the meeting of the second commission, that it might not seem to be in any way a criticism upon its work. Now that both commissions have made public their findings, the whole matter is easily accessible, but Mr. Clark is hardly just to the first commissioners on either side, by the slight reference he makes to their separate reports to their respective governments. A more careful study of both might have led to some modification of his views, even concerning the partition of authorship which he has ventured to make. It is no mean compliment, however, to find him admitting, in regard to the report of the American commissioners, that "not a single statement of fact in it has proved fallacious, and the more exhaustive investigations of 1896 and 1897 corroborate its conclusions in every particular." And this admission lies adjacent to his assertion that "the investigations conducted by the two commissions [of 1891] were, from a scientific point of view, of the nature of a farce." The fact is, Mr. Clark seems to have strangely misunderstood the character of the investigations which were contemplated and desired. The natural history of the fur seal was not the question submitted to the joint commission, except in so far as it specially affected seal life in Bering Sea and the measures necessary for its proper protection and preservation.

"Facts, causes, and remedies" were the subjects to be considered. There is an old saying that the flavor of the pudding may often be revealed by chewing the string, and no long and exhaustive investigation was necessary to enable the American commissioners to arrive at what Mr. Clark admits to be the "facts, causes, and remedies" for the Bering Sea problem. Not many weeks were occupied in the field, it is true, for the commission was delayed in its appointment and notification, and the season was nearly over when it reached the islands. But, as Mr. Clark justly remarks, one member of the commission, Dr. Merriam, was already exceptionally well informed concerning the habits of the fur seal, and some things may be so in evidence that even a physicist can see them.

It is true that the *joint* report of the commission of 1891–'92 was meager, and the explanation lies close at hand in the unwillingness of the American commissioners to swerve from what they were convinced was absolutely true. Mr. Clark will look in vain for the "handwriting of diplomacy mingled with that of science," for the appearance of which in the report of the commission of 1897 he offers apologies, except, indeed, it be the diplomacy of going straight at the facts without concealment or evasion, on which Americans have sometimes prided themselves.

The joint report was limited to that, and only that, on which the commissioners were actually agreed, and the American commissioners have explained in their separate report that had they been willing to concede certain points the joint report would have been greatly augmented in volume. Mr. Clark has reviewed the conclusions of the commission of 1897, which he justly considers a most important and valuable document. It has not escaped his attention that in a number of the paragraphs of this report the American commissioners have committed themselves to the approval of several doubtful statements, such as that "the pelagic industry is conducted in an orderly manner, and in a spirit of acquiescence in the limitations imposed by law"; that a certain number of females may be killed without involving the actual diminution of the herd; the "tendency toward equilibrium theory"; that the herd is still far from a stage that threatens extermination, and others. These statements he excuses as "balm for the wounded feelings of the pelagic sealer"; "a concession to diplomacy"; "a diplomatic concession to take the sting out of the real admission"; "another concession to diplomacy," etc. I do not wish to be understood as questioning the necessity or wisdom of inserting these paragraphs in the joint report, but is it not a little strange that with them in, and apologizing for them as he does, Mr. Clark should have selected this as a model of what the report of a scientific commission ought to be and sufficient of itself to forever fix the value of the scientific expert in the settlement of government disputes? As I have already intimated, no one appreciates more highly than I the great work done by Dr. Jordan and his associates in the study of the natural history of the seal. May not the work of the two commissions, as *bearing on the problem of the fur-seal industry*, be summed up about as follows?—The report of the American members of the first commission related facts, declared causes, and proposed remedies. The American case at the Paris arbitration rested on these. As almost universally happens, arbitration resulted in compromise, unsatisfactory to both parties, and, as has since turned out, decidedly unfavorable to one. The commission of 1897 has made a joint report of considerable length and much importance, in which the "facts, causes, and remedies" of the report of 1892 are in a sense confirmed, but with a number of concessions that do not strengthen the American contention regarding pelagic sealing, the justice of which seems to be admitted by Mr. Clark. But the practical question is, What has been the effect of either or both of these commissions upon the fur-seal industry? It would be unkind to press this question upon one who characterizes the work of the first commission as above quoted, and who speaks of the second as having, after being in joint session one week, "concluded its labors, reaching a full and satisfactory agreement." If he really wishes to know what progress is being made under such an agreeable state of affairs, let him inquire of the International Joint Commission, which is endeavoring to arrange all outstanding differences between this country and Canada.

CAUSES AND PREVENTION OF INSANITY.

By SMITH BAKER, M. D.

IT is being found out that cases of insanity may of themselves fall naturally into two classes: the first comprising those who get well, and the second those who do not. To the first class belong the deliriums of fevers and other like diseases, and also certain acute manias and melancholias and the so-called generalized insanities. In the second class are included the insanities which last indefinitely, or, if seemingly cured, which, in the proportion of from twelve to fourteen per cent, come back again one or more times, and finally do not recover. Says Regis: "Out of all forms of mental alienation or insanity only the generalized types—i. e., mania and melancholia—are curable. The systematized insanities are essentially chronic and recover only exceptionally" (Practical Manual of Mental Medicine, page 54). The latter are known by such specific names as paranoia, chronic mania, chronic melancholia, insanity of doubt, circular insanity, hereditary insanity, and the like. What makes such a division of insanities into these two classes significant is not only that those of the first class get well and the others do not, but that, generally speaking, these latter are so founded in the constitution of the individual that they can not recover, let everything as yet possible be done for them as it may. Probably there are exceptions to this; but, if so, they are not very often met with. All these cases seem to be doomed from the very first either to follow a slowly downward grade to the very end, or else to manifest a series of alternate better and worse stages, which, while giving rise to bright hopes of ultimate recovery, nevertheless just as surely tend more or less rapidly downward, in pretty strict accordance with the rule. In passing, it may be noted that not only the tragedy of such alternations of emphatic despair and delusive hope constitutes not the least of the wretchedness involved in the history of these cases, but that it is by no means the easiest thing about them to manage; for, in the earlier stages, it is almost impossible to make associates or relatives understand the full meaning of the disease, or to take a correct view of its probable outcome. Even much later on they cling to the possibility of recovery, which is as delusive as it is painful, for the disease goes on, nevertheless, with varying stride and manifestation, until it finally becomes evident that hope is almost absolutely without any real foundation.

Now, when a case of persistent or recurrent but really irrecoverable insanity is studied, with respect not only to the life of the individual affected but to the lives of his ancestors, both remote and near, and in sufficient detail, it is seen that the causes of the present breakdown have been long and surely operative in those from whom he has inherited certain unfavorable characteristics, and at whose hands he has had his bringing up and education; and this even much more weightily than in himself or the life which he has lived. So far as the patient's own responsible life is concerned, the common causes, such as accident, infection, overwork, mental and moral strain—in fact, all the usual forms of stress—have, of course, been just as variously to blame, and in just the same way as they have been in the production of insanities in other individuals who finally recover. But even in respect to these latter, it probably may be most frequently discovered that the harmful effects of certain so-called exciting causes have been experienced, not because of the common emergencies and exigencies of life so much as because of some peculiar but unrevealed characteristics which have produced and maintained a sort of vicious maelstrom into which have been attracted all the detrimental influences that have accidentally or intentionally come within reach. For instance, such persons are almost always predetermined to grow up into harmful bodily and mental habits. Says Peterson: "Among all degenerates there is a taste or appetite for certain foods or drugs which tend to favor their dissolution (alcohol, morphine, cocaine, and the like" (State Hospitals Bulletin, vol. i, p. 372). So also are they apt to be wrongly educated, or to draw around them harmful associates; to develop the most wearying and exhausting enthusiasms, or to choose a business and place of residence to which they are not adapted; to marry some one who will chiefly wear and burden them; to assume responsibilities and positions out of keeping with their native strength and endurance; in fact, to get entangled in all the affairs of life in just the very way calculated to bring about the one thing which should have been, by every known means, sought to be avoided. It is in this way that "physiological fate" unconsciously spins the web which ultimately fastens its own doom. That such a pernicious course should eventually result in disaster is no wonder at all; for when investigated deeply and comprehensively enough, it is seen that of all possible persons, such are, by birth, the very least calculated to endure the wear and tear thus engendered and maintained; while, as scarcely a word is ever heard and scarcely an effort is ever made as to the necessity for so training and educating and inspiring these people that the defects of heredity will be remedied, it follows that the most ordinary ventures of commonplace life are by far more dangerous to them than to their better-endowed fellows.* When properly endowed by heredity, and adequately bred and educated, it is almost beyond wonder, the amount and character of persistent stress which human nature can triumphantly endure. When otherwise, however, it is no wonder at all that sooner or later serious breakdown comes to pass.

The importance of saying this is obvious when we consider that as a rule active life is allowed to be entered upon without adequate preparation and intelligent adaptation of either bodily or mental strength to the stress that is likely to be encountered. Always it is asked, if anything is asked at all, "Has he the skill to make his way?" instead of, "Has he the prospective endurance required by what he purposes undertaking?" while, if the latter chances to be considered at all, the conclusion is most usually based upon present appearances rather than upon past tendencies or actual developments. Elsewhere I have said: "In almost every instance (of breakdown) I

* "It is perfectly certain that two in every three children are irretrievably damaged or hindered in their mental and moral development in the schools; but I am not sure that they would fare better if they stayed at home."—Baldwin, in *Mental Development*, p. 38.

have come across the result of some big educational blunder, owing either to the system in vogue or else to those who execute it." (See Steps toward Insanity, New York Medical Journal, August 14, 1897.)

There is one fact about heredity which seems not to be commonly considered—namely, that each individual is really the descendant of not only his immediate parents, but of the two lines of ancestry indefinitely far back and widespread. Thus, in many instances, the dominating characteristics are not those of father and mother, but of grandparents, or of some other antecedent or collateral relatives instead. In fact, each individual in its development from the germ to adulthood passes through not only many animal forms, but through many ancestral phases of character as well. And, as in the first case, the size and strength of adult physical features depend on the stage at which growth becomes abnormally extended, perverted, or arrested, so, with regard to mental and moral qualities and their persistence under stress, the outcome mostly if not entirely depends upon the extent to which they are allowed or constrained to develop, or the reverse. Here we often see the absolutely limiting influence of "atavism," or what is characterized as "reversion," to generations further removed than the parental, but which really is the result of an exaggeration or a stoppage, or a perversion of development before the stage of parental dominance is finally reached. In this way the featural and mental characteristics of relatives as far removed as great-grandparents or great-granduncles, as well as grandparents and uncles, are seen to appear in children even when young, to be finally either accentuated and made prominent, or else possibly outgrown or otherwise overcome as the years go by, and as the later parental determining powers and the corresponding environment come to manifest their influence.

With this view of heredity in mind, it is easy to see how the real basis of every mental breakdown may be and probably is simply an overdoing or perversion or other irregularity at some premature or "atavistic" stage of development; and that anything and everything which may have had to do in causing this should be considered as a primary step toward the insanity itself. But easy as it is to see this theoretically, it does not necessarily follow that it is easy to get hold of the real facts or to help the matter in any given case. Many times families are loath to reveal things which might indicate such a basis of the dreaded disease. Many times they do not recognize the necessity of telling what they would otherwise be willing enough to reveal. Many things are absolutely forgotten or have been at best only vaguely comprehended. Sometimes conscious deception is practiced; at others, the party who really has known the facts is dead or is otherwise inaccessible. But more often, and more interfering still, is the unconscious perversion of facts, either from the false meanings which, owing to specific views and predilections and fears, are read into them, not only by the laity, but often by the profession, or else from the wrong deductions derived from actual facts clearly understood. Try as one may, it is often most difficult to get a sufficient number of clearly defined facts to enable even the most expert to form a true and comprehensive idea of the case in hand.* This leads to the remark that what is now absolutely needed is some form of record-keeping which shall become a general practice on the part of heads of families and their physicians, and which may be handed down from generation to generation; and not only this, but that these shall be so accurately and fully kept that they may be worthy of consideration as the best and in fact the only basis of a scientific generalization in case of mental or moral emergency. That people as a rule would probably resent this, as constituting an undue interference with the sanctity of personal and family rights, while undoubtedly rendering it practically nugatory for the time being, does not in any good sense militate against either the scientific need or the great good which would accrue from the use of such family records faithfully and intelligently kept. It is encouraging to note that already the way for such records is being opened in the demands made by the various *questionnaires* sent out by Dr. G. Stanley Hall and others who are interested in the scientific study of children. (See various issues of the American Journal of Psychology, and of the Pedagogical Seminary, for pertinent suggestions and results. Also an article by Dr. William H. Thomson, in the Yale Medical Journal for April, 1898.) Much more useful and in general satisfactory would this be than the blind staggering after elusory causation now so universally and yet so futilely pursued.

And the same may be said with reference to statistics as commonly tabulated. These having reference but to the surface showings, the after-the-mischief-is-done results, and so often obtained under misleading constraint or other unfavorable influences, are scarcely capable of even hinting the significance of real conditions, and especially of tendencies that have existed antecedent to the individual breakdown. For instance, such statistics as those compiled by Dr. Wise (see State Hospitals Bulletin, vol. i, page 157), when subjected to the requirements of an accurate causative consideration, easily lend themselves to the criticism made by the author himself, who says, "The careful inquirer can receive no reliable information from the study of insane hospital statistics except the bare

* See an instance clearly elucidative of this in an account of the Kelly murder trial, given by Dr. Walter Channing in the American Journal of Insanity for January, 1898, page 385.

fact of the number of insane persons under care and treatment." Yet a glance at his tables shows that forty-two per cent of the cases admitted to the New York State hospitals for the year ending September 30, 1895, are to be noted as suffering from constitutional degeneracies, and so presumably to be incurable. The more than twenty per cent of cases of insanity reported to have had hereditary antecedents, although undoubtedly as accurate as possible under the circumstances, merely chronicle the more obvious matters, and must necessarily have left out of account all the less obvious but in many respects even more important ones. And so with all the other series thus far published. They are good as indicating where we are to look for some of the steps toward insanity, but for the most part they are quite inadequate for a basis of comprehensive discussion or anything like accurate conclusion.

The pressing need, then, is that there shall be obtained a series of statistics which shall be founded upon the most definite, penetrating, and far-reaching studies of cases that it is possible for the trained scientist, with the help of an intelligent, willing laity, to make. In this respect it may be said that the assistance of the latter is just as essential as the painstaking devotion of the former; for it is upon the facts which an intelligent laity can observe and report that the scientist can bring his training to bear in such a way as to arrive eventually at accurate and therefore most useful generalizations. But such concurrent observation and study will never be until the public shall have come to look upon insanity as merely an unfortunate disease instead of a stigmatized disgrace, which, with certain exceptions, it should not be considered to be. Nor will this be the case until professional examiners in lunacy shall regularly ask for such family records, and thus create a need for their being made. When both the public as well as the profession lay aside entirely the common notions of a transcendental origin of insanity, and set to work to study the perfectly natural steps through which degeneration and breakdown eventually come to be, all will see the desirability of such health records being accurately and fully kept, not only as a help toward determining the nature and prospects of any given case, but also toward preventing the development of those constitutional tendencies which lead to trouble, as well as in helping on those that provide against it.

When we come to study the causes of insanity with a view to successfully preventing it, we are led to the supposition that the nearer to very first steps we can push our investigations the greater will be our service. Remembering that the well-born, well-bred personality generally bears almost every sort of stress with comparative impunity, it becomes us to ask just how does the opposite—the ill-born, ill-bred—constitution come so to be, and hence to break down so easily. Certainly, the weak, easily breaking strains must have their origin and growth just as definitely as the more enduring ones, and if we can get an accurate notion of such origin and the conditions of subsequent growth, it seems probable that useful knowledge will thus be attained.

With this object in view an investigation was undertaken which should cover the life histories of a series of families with sufficient detail and extension to warrant at least tentative conclusions as well as also to indicate probable lines for future work. So far as possible, inquiries were pushed along collateral as well as direct lines of ancestry; and not only ill health but common habits and experiences were, so far as possible, given the consideration strictly their due. In every way the attempt was made to properly estimate the factors appertaining to the more intimate personal life as well as those that were more obvious and impersonal. Often, however, the completed record proved to be more or less broken; more often still, important items—the most important of all, in fact—could only be obtained under promise of absolute secrecy as to future use. So, as matters of absolute science, the following conclusions must stand chiefly as challenges for future confirmation or change. But, so far as they can be allowed to go, they may be accepted as pretty thoroughly based in ascertained fact and legitimate generalization.

The very first conclusion, so far as the natural history of the steps toward insanity is concerned, is that the weak constitutional strands and tendencies have their beginnings in those ancestral marriages which, chiefly for educational reasons, I have chosen to call "unphysiological." * By an unphysiological marriage one need not mean a marriage between people obviously deformed or imbecile or insane, or otherwise permanently unfitted, but rather between people who are found to be not well adapted to each other in some important sense. Thus, too great physical disproportion; too great disparity of age, or of temperament, or of family or of natural tendencies; or, on the other hand, too near a sameness, either through consanguinity or other sources; or too fixed constitutional characteristics; or even too great differences of education, religion, taste, or ambition. In fact, it seems probable that anything and everything which difficultly amalgamates in marriage, and as surely fails to blend in progeny, may be considered as unphysiological in this connection. As I have said elsewhere: "The parties entering into such an unphysiological marriage may both be normal individually, but yet not physiologically marriageable, because they are either too distantly or too nearly, or in fact too unphysiologically, related, either physically or psychic-

* See New York Medical Journal for August 14, 1897.

ally. In such cases the ultimate outcome is almost absolutely certain, and is noted chiefly by a definite class of tensions and reactions of both mind and body which invariably impress themselves upon progeny, and which for the most part are made obvious in this particular way. No matter how unphysiological such marriages may be, however, they do not necessarily or very often result in the evolution of insanity in the parties contracting them, but rather they do lay the foundation of degenerative tendencies which almost invariably predetermine the development of this affection in more or less remote succeeding generations. Nor do the children of such marriages necessarily or generally become insane, although they sometimes do; but, impressed as these are by the degenerative malnutritions and tensions and reactions of their parents, they tend to exhibit arrests and eccentricities of development, which in turn become intensified in the next, and again, in turn, in all the generations following, until the instability becomes so marked that explosion occurs. In passing, it may be said that the most frequent source of the initiatory tensions and reactions resulting from unphysiological marriage is undoubtedly found in abnormal cohabitation, and the unrest and unsatisfaction and exhaustion resulting therefrom. Such a condition of things begets in perfectly normal people an irritating, nagging, exhausting, persistent erethism, which in time involves the whole organism and deflects it from its norm. Two people enmeshed in such a bond always go to excesses and irregularities, either in abstinence or indulgence; or, if not this, then the whole matter becomes aversional, with straining antipathy, perverting practices, and ideational distrusts and loathings more and more predominating. No wonder that such people predetermine succeeding generations to abnormal sensitiveness, irregular growth, and erratic manifestations in both mental and physical spheres." (See New York Medical Journal for August 14, 1897; also Journal of Nervous and Mental Diseases, vol. xvii, page 669.)

Now, the outcome of such marriages seems to be a vitiated stream of tendency, which carries with it in its progress from generation to generation certain elements which predetermine to still fuller vitiation, even with incurable insanity, as noted above. Thus, people endowed with such natural characteristics, being altogether too prone to gravitate toward each other, eventually marry, and thus emphasize in progeny the vitiation already doubly initiated. Natures's course demands that such people marry, if at all, into the healthiest, most corrective stock possible. But here immediately there arises not only a scientific prohibition, but an ethical question which should be heeded: Should such people really marry even the best of stock, with the probability of thus vitiating a stream which until this time has evidently been becoming clearer and stronger? Again, people who are constitutionally tending to mental breakdown are very apt to load themselves down with duties and get themselves into situations which must necessarily prove to be too onerous and too perplexing for their poorly developed strength and skill. Of course, circumstances often require this. Many times, however, there is a kind of impulsive restlessness coupled with a short-sighted optimism, both constitutional, which, altogether more than ordinary circumstances, are to blame for undue assumption of work or care, and whose effect is, perhaps, best seen in the persistent tendency of such people to originate and perpetuate exhausting habits, both of mind and body. Thus, the habit of self-poisoning from poorly digested and poorly assimilated food is easily acquired by such people, and always becomes a source of progressive brain starvation and often of consequent mental breakdown. Says Dr. A. S. Thayer (Journal of Medicine and Science, vol. iii, page 173), "There is ground for belief that exhaustion—fatigue—is dependent upon poisoning of the cells of the brain, muscles, and other tissues by the waste products of functional activity." * Again, as already noted, perversions of the natural instincts—of appetite for food, of desire for gain, of social or other ambitions, and especially of the sexual impulse and its habitual indulgence—fasten themselves upon such individuals with a permanence and destructiveness that must almost of necessity lead to disaster.† And so we may see that as a most natural, although often a far-removed, result of unphysiological marriages, proceeding through generations which have been thus predestinated to weakening choices and practices, insanity finally appears to mark the ultimate extent both of the mental disorganization and bodily inefficiency, which extent is owing not only to the original initiating steps, but also to subsequent stages of causation, progressively developed from generation to generation.

Another great source of vitiation of the stream of tendency is found in two people who marry in a truly enough physiological sense, but who find or force themselves in lives of wear and tear which progressively unfit them for childbearing and child nurture. Poorly calculated ambitions, unexpected difficulties to be surmounted, depressing oppositions, with perhaps more or less actual disease or accident, largely account for this in a general way. Obviously, during the child-rearing age, the effect of what parents are obliged to endure and execute upon the fortunes of progeny becomes a matter of far-reaching importance. That anything which persistently exhausts or overstrains the parents must tell in the later dynamic tendency and

* See also Dr. Edward Cowles. Shattuck Lecture on Neurasthenia.

† See Peterson. The Stigmata of Degeneration. State Hospitals Bulletin, vol. i, p. 327.

development is premised at least by certain recent studies, especially those of Hodge on the influence of fatigue, and of Van Gieson on the effects of exhaustion and intoxication upon the nervous elements. (See also Peterson, *op. cit.*) In no sense can parents be said to live for themselves chiefly. Always the influence of their own health, happiness, and prosperity upon their children should be remembered, and should be made as constructive as possible. That this can be consciously attempted with commensurate results is more or less evidenced not only by common observation but by investigation. Not, however, in the sense that parents are always able to endow children with some particular, much-wished-for characteristic, as so many suppose—for it must be remembered that perhaps pretty fixed tendencies for several generations may have to be overcome and reversed before such special results can be obtained, but in the much better sense of giving such an impetus healthward and strengthward and lifeward as may later on be the beginning of a constitutional foundation that shall support many generations of full health and longevity.

If, then, the first steps—and, generally speaking, the most important steps—are discovered in the unphysiological marriage and its influence upon the bearing and rearing of progeny, then it is obvious enough that prevention of incurable insanity should begin with giving adequate attention to this phase of the subject, and this first and emphatically. Already the law says that certain peculiarly afflicted individuals can not marry; and probably this is about as far as the law can helpfully go until, at least, public intelligence as well as private sentiment will sustain it in going further. So we must look to these latter—a widespread intelligence and a corresponding earnest sentiment founded upon such intelligence—for the means of making progress toward the prevention of insanity. But how can this needed knowledge and helpful sentiment come to be? Certainly not by perpetuating the present notions of so-called "modesty" and "purity," which, as now held, must always interfere with the study and practice necessary for ascertaining the truth, and for applying it to the needs of race-building. The time ought to come soon, very soon, when matters of such serious content shall not be so absolutely subject to the dominance of conventionality and guesswork and recklessness as now, but shall instead be subject to the sway of accurate science and its careful adaptation to human conditions. Every marriage now is at best but an experiment—blind and chance-taking often, in a most wasteful and dangerous sense. Let it remain, if it must, an experiment still, but one which shall be henceforth conducted with such foresight and skill, and withal with such intelligent purpose, as shall certainly point to improved results from generation to generation. Experience shows that it is comparatively easy to ascertain what marriages, generally speaking, are prone to result in obviously vitiated progeny; or if not in these, then, to some extent at least, in the progeny which, being unnaturally constituted, are prone to develop their weaker strands of personality, and so to break down in the end. But to this course neither prudery nor superstition nor selfishness will ever assent; it must be pursued in spite of these, and by the only method which science now recognizes—namely, accurate observation, careful record, and the most comprehensive, skillful comparison, all in order that truthful inductions may be finally secured. That parents should train up their children to look forward to marriage not as the acme of personal indulgence and satisfaction, but as a most responsible partnership for the developmental keeping of unborn fortunes, and the proper nurturing of the children that may come to them, is no longer speculation, but a science-founded fact. Undoubtedly the highest state of adult satisfaction will always be closely associated with what may be characterized as child completion. Moreover, that an educational system which so thoroughly ignores this most important of all educational subjects must, in time, be subjected to the criticism which science may justly develop, is amply borne out by the cases studied. Often, indeed, has it appeared that had a modicum of real knowledge been at hand, most disastrous results would naturally have been obviated. Educators lead the day; why not they lead in directions which shall most truly correct the results of physiological ignorance and daring? That no man or woman should go forth from college with such vital knowledge unlearned is probably the first and most important means of preventing incurable insanity conceivable; and that these in turn should never hesitate to diffuse popularly that which they have been so favored in the learning, implies a duty which the intelligence itself makes clear.

So, too, if persistent overstrain and exhaustion of parents, either prospective or actual, leads directly to starvation of their own structural elements, how probable that the initiating and bearing and nurturing of children is to a like extent detrimentally interfered with in any given case through the development of an "erratic cell growth." Certain it is that completeness of development depends on two things—namely, nutrition and exercise. In a biological sense both these are dependent upon a right adjustment of supply to demand. Hence starvation or engorgement, inactivity or overwork, each may lead to the same dynamic result—that is to say, to an interference with the proper growth of the organism. That due heed, then, should always be given to the necessary health preservation of those who essay to become parents, not only in preparation for but during the whole so-called childbearing period, is so scientifically deducible that it may be for all practical purposes considered as axiomatic. The way to have healthy, long-lived, and happy children is for parents to be healthful and intelligently careful themselves; while the whole science of health must eventually consist in the science of such symmetrical and high development as will enable individuals to endure necessary strain, resist disease, and rapidly and fully recover from accident and infection.

SKETCH OF WILLIAM PENGELLY.

THE name of William Pengelly is most closely associated with the explorations of caves in England containing relics of men together with the remains of extinct animals, the results of which, confirming similar conclusions that had been reached in France, convinced English geologists of man's extreme antiquity. Speaking of him at the time of his death as one of the last survivors of the heroes who laid the foundation of geological science, Prof. T. G. Bonney said, "He has left behind an example of what one man can do in advancing knowledge by energy and perseverance."

WILLIAM PENGELLY was born at East Looe, a fishing village in Cornwall, England, January 12, 1812, and died in Torquay, March 16, 1894. The name of Pengelly is not uncommon in Cornwall, and has figured in English history—among others, in the person of Sir Thomas Pengelly, who was chief baron of the exchequer, and left certain sums for the discharge of debtors from the jails of Bodmin and Launceston. His father was captain of a small coasting vessel, and he acquired a strong attachment to the sea. He was sent to the Dame's School in his native village when very young, and before he was five years old had made so rapid progress that his mother applied to the master of a school for larger boys to receive him as a pupil. The master declined to take him, but, hearing him reading as he passed the door of the house not long afterward, concluded to grant the mother's request. At school he soon gained such a reputation for scholarship that the boys made him spend all his play hours helping them in their lessons. His school days ended when he was twelve years old, and he accompanied his father to sea, making, however, voyages that were seldom more than three days long, most of the work of which consisted in taking in and taking out cargo. The sailors soon discovered his clerkly gifts and employed him to write their letters, but did not so well appreciate his excellent conversational powers. On "tailoring days" it was understood that his clothes should be repaired for him, while he read aloud for the general benefit, and the sailors would amuse themselves by finding solutions to questions in Walkingham's Arithmetic. His seafaring life closed in his sixteenth year, when the death of a brother made it desirable that he should remain at home.

Though working hard all the day for a mere support, young Pengelly managed to spend several hours every night in study, seeking to master mathematics. He had no tutor and no really good text-books, but made such progress in his studies that in a comparatively short time he became "a mathematical tutor of no mean order." He bought his first Euclid of a peddler who occasionally visited the place; then, having saved up a little money for the purpose, it was a happy day for him when he walked thirty miles to Devonport and back, bearing, on his return, twenty volumes in a bundle over his shoulder; among them were the works of some of the standard authors, for he cultivated a literary as well as a mathematical taste.

He received his first lesson in geology while he was still a sailor boy, at Lyme Regis—a spot exceedingly rich in fossils. A laborer whom he was observing broke a stone, the opening of which disclosed a fine ammonite. To his question as to what the fossil was, the laborer replied that if he had read his Bible he would have known; that there was once a flood that covered all the world; the things that were drowned were buried in the mud, and this was a snake which had suffered that fate. "A snake! but where's his head?" He was again referred to the Bible, which would tell him why the snakes in the rocks had no heads. "We're told there that the seed of the woman shall bruise the serpent's head. That's how 'tis." The second lesson came a few years later, in a reading club of which Pengelly was a member. They were reading Dick's Christian Philosopher, and came to a geological section, when the reader remarked that "as geology was very likely to be extremely dry, and as many good people thought it dangerous if not decidedly infidel in its teachings, he would propose that the selection should not be read. This was passed by acclamation, and the reader passed on to astronomy."

While still young, Pengelly removed to Torquay, where he spent the remainder of his life. Shortly after arriving there, he opened a small day school on the Pestalozzian system, into which he introduced the novelty of the use of chalk and the blackboard in giving instruction. Beginning with six pupils, the school grew rapidly. He had private pupils, too, and in 1846 these had become so numerous that he gave up his school, and as a special tutor in mathematics and the natural sciences found his life occupation. Some of his pupils became distinguished in after life; while others, like the two Russian princes, nephews of the Czar Alexander II, and Princess Mary, of the Netherlands, all of whom became much attached to him, were famous by reason of their position. His attention was brought for a third time to geology while looking over some books which he thought might be useful to his pupils, when he found one published by the brothers Chambers, which contained a chapter on that science. This was not much, but it was enough to inform him how much had already been done in geology, and, perhaps, to give him a hint of some of the possibilities that lay in it. From this time on, he was ardently interested in geology. The journal of his first visit to London and the British Museum, in 1843, attests how he was becoming absorbed in it. He spent his holidays in geological explorations and in excursions which gradually grew larger, until his position as a geologist was recognized, and he became an authority respecting all points and phenomena which had come under his personal knowledge. A hint dropped to him by Professor Jameson as he was about to visit the Isle of Arran taught him to make his notes of observations on the spot, and greatly helped, his daughter Hester observes in the biography on which we have drawn very largely, "to form those habits of extreme accuracy which characterized all his scientific work."

In 1837 Mr. Pengelly assisted in the reorganization of the Torquay Mechanics' Institute, with which he maintained a connection for more than twenty years, and before which he delivered many lectures. In 1844 he participated in the organization of the Torquay Natural History Society, of which he became, in 1851, honorary secretary, and remained so for more than thirty-nine years. "Under his guidance it became a scientific power in the country. Year after year he lectured there, tincturing the locality with his own enthusiasm; and from the society there ultimately sprang the museum in Babbacombe Road, with its admirable collections."

His lectures, delivered gratuitously at Torquay, were very popular, and were attended by large audiences. The fame of them spread, and he was called to other places—Exeter, Exmouth, and larger towns and farther off, and to the great learned societies—where he lectured, always with success, and to the satisfaction and delight of his audiences. "Those persons living, and they are many," says Mr. F. S. Ellis in the preface to Hester Pengelly's biography of her father, "who had the good fortune to hear Pengelly lecture will bear ready witness to the complete mastery he always had of his subject, and of the faculty of imparting his knowledge. Even when speaking upon abstruse subjects to a mixed audience, he would make the matter perfectly clear without in any degree appearing to talk down to the capacity of those he was addressing. . . . His manner was no less pleasing and attractive than the language in which he clothed his ideas was grateful to the ear." Geology and astronomy furnished the subjects of the lectures.

It would be impracticable in a brief sketch to follow the detail of Pengelly's geological investigations previous to his engaging in systematic cave exploration. They embraced fields chiefly in Devonshire and Cornwall, and afforded subjects for correspondence and discussion with many of the most eminent British geologists, and some of other countries than England. A study of some fossil fish, first observed by Mr. Charles W. Peach in Cornwall, furnished the occasion for one of his first recorded papers, On the Ichthyolites of East Cornwall, in the Transactions of the Royal Geological Society of East Cornwall, 1849–'50; and a single volume—the seventh—of these Transactions contains nine of his papers. Another subject of interest was the beekites, curious formations of chalcedonic silica on the limestone fragments in the New Red Sandstone of Devonshire, first observed by Dr. Beek, of Bristol, concerning which he read a paper at the Cheltenham meeting of the British Association, the first which he attended, in 1856. In 1860 he completed the formation of a collection of Devonian fossils from Devon and Cornwall, which was presented by the Baroness Burdett-Coutts to the new museum of the University of Oxford, in connection with the foundation of a geological scholarship, and was named "the Pengelly Collection."

The first of the more important geological researches with which Pengelly's name is intimately associated was the exploration of the peculiar formation at Bovey Tracey, for the identification of its fossils and the determination of its age. The plain in which the formation lay had an aspect suggesting the basin of an ancient lake, and its deposits, "very different from the solid rocks of the surrounding hills," confirmed the suggestion. They consisted of gravels, sands, and clays, distinctly stratified, with seams of lignite, for which they had been worked. The pits had already attracted some notice, and the deposits had been mentioned in scientific literature, but very little had been learned concerning their age. In 1860 the subject was mentioned by the late Dr. Falconer, an eminent paleontologist, to Miss Burdett-Coutts as one the investigation of which would be a boon to science. Miss Coutts supplied the money that was needed, and the direction of the systematic investigation was intrusted to Pengelly; on learning which, Sir Charles Lyell wrote to him: "I am very glad of the prospect of our knowing something of the Bovey coal plants. It is almost a reproach to English geology that they have been so little explored, as they are perhaps the only fossils of the Tertiary period to which they belong." In order to determine accurately the nature, thickness, and order of the successive beds, and to make a satisfactory collection of fossils, a new section of the deposit was made, measuring one hundred and twenty-five feet, down to the bottom of a seam of lignite four feet in thickness, the "last bed" of the workmen, but not at the actual base of the deposit.

Thirteen of the thirty-one beds of lignite which were cut through, and two of the beds of clay, yielded distinguishable plant remains. These were sent to Dr. Oswald Heer, of Switzerland, for examination; and he determined from the collection fifty species, including ferns, conifers, figs, cinnamon trees, an oak, a laurel, vines, andromedas, a bilberry, a gardenia, a water lily, and some leguminous plants. Heer referred the group to the Lower Miocene period, but some modification was afterward made in this determination in the light of a fuller knowledge of the Tertiary flora. The deposits and work at Bovey Tracey were the subject of a memoir to the Royal Society by Sir Charles Lyell; and Dr. Heer's account of his work—The Fossil Flora of Bovey Tracey—was published in 1863.

While this investigation was going on, Lyell was preparing the fifth edition of his Manual of Geology. He invited Pengelly to suggest corrections to the text, saying that, besides positive mistakes, he would "be glad of any hints and suggestions made freely, which your knowledge of the manner in which beginners are struck may enable you to send us." The criticisms supplied by Mr. Pengelly were adopted by Lyell except where they had already been made unnecessary.

On the accidental discovery by workmen, in 1858, of a cavern in Windmill Hill, overhanging the town of Brixham, Pengelly at once thought of finding what was in it, and what story it might have to tell. He visited the place and applied to the owner for permission to explore it in behalf of the Torquay Natural History Society. But on consultation with Dr. Hugh Falconer it was decided that as that society probably had not means sufficient to bear the expense of the exploration, the Royal and Geographical Societies should be applied to for a grant. This was obtained, and the work was carried on under the superintendence of Professor Prestwich and Mr. Pengelly, on whom, as a resident of the place, the burden substantially fell. The decision to explore the cave was brought about largely by the fact that it was a virgin cave which had been inaccessibly closed during an incalculably long period, the last previous event in its history having been the introduction of a reindeer antler, which was found attached to the upper surface of the stalagmitic floor. It was therefore free from the objection urged against Kent's Cavern that, having been long known and open, it had probably been ransacked again and again. A thorough method of exploration was determined upon, beginning with the examination and removal of the stalagmitic floor; after which the upper bed should be dealt with in a similar manner horizontally throughout the entire length of the cavern, or so far as practicable; then the next lower bed, and so on, till all the deposits had been removed. By this method the general stratigraphical order of the deposits and their characteristics could be learned, all their fossils secured, and the highest possible exactness attained. The excavations were continued through twelve months, at the end of which the cave had been practically emptied. Besides furnishing interesting indications relative to its physical history, the cave yielded sixteen hundred and twenty-one bones and thirty-six flints. While most of the flints were flakes, some of which possibly might not be artificial, three were fairly well made implements of paleolithic type; and it was therefore concluded that man either frequented or at any rate sometimes entered the Brixham Cave while Devonshire was inhabited by various mammals which are now extinct. Previous to the execution of this work, all geological evidence as to the antiquity of man had been received, even by English geologists of the first rank, with what Pengelly called apathy and skepticism. After the work it soon became evident, Pengelly said in an address to the Section of Anthropology of the British Association, in 1883, that this geological apathy had been more apparent than real. "In fact, geologists were found to have been not so much disinclined to entertain the question of human antiquity, as to doubt the trustworthiness of the evidence which had previously been offered to them on the subject." The discoveries are thought to have had a considerable share in disposing Mr. Prestwich to undertake the investigation of the remains at Amiens and Abbeville in France and Hoxne in England, "which added to his own great reputation and rescued M. Boucher de Perthes from undeserved neglect." Prof. Boyd Dawkins says that they established beyond all doubt the existence of paleolithic man in the Pleistocene age, and caused the whole of the scientific world to awake to the fact of the vast antiquity of the human race. Of course, they aroused a theological controversy which was long and bitter, and has only recently died out. Pengelly had no trouble through it all. "Geologists," he said, "see no mode of reconciling the Mosaic account of creation with geological science. . . . For myself, I am satisfied that science can do nothing for the salvation of the soul, and that the Bible is able, through God's grace, to make us wise unto salvation." No doubts or difficulties could ever undermine his faith as a Christian..

The evidence accumulated at Brixham suggested the propriety of a re-examination of other evidences of man's antiquity, and particularly, in England, of those from Kent's Hole, or Cavern, at Torquay. The existence of this cave had been known from time immemorial, but the first recorded exploration of it was made in 1824 by Mr. Northmore, of Cleve, looking for organic remains and an ancient temple of Mithras. Mr. W. C. Trevelyan followed him, and first obtained results of value to science. The Rev. J. MacEnery, a

Roman Catholic priest, began a four years' exploration of the cave in 1825, and prepared a narrative of his work, which was not published for several years after his death, having been lost, and found by Pengelly after a long search. He showed that the cave had been inhabited, practically at the same time, by man and various extinct animals; but the antiquity of man not being yet a live subject, little regard was paid to his evidences. With a grant of a hundred pounds from the British Association, the work was begun under the direction of a committee of which Pengelly was the leading spirit and the working member. It opened a new chapter in his life, his daughter says, "for he not only superintended the exploration of the cavern, but undertook its entire management, throwing himself, heart and soul, into the numerous duties which it entailed. The labor was arduous, and severely taxed his energies for fifteen years; but it was a congenial employment, and most faithfully performed. . . . After undertaking the exploration, Pengelly became such an enthusiast in the progress made that, when in Torquay, he never (unless prevented by illness) failed on a single week day to visit the cavern, while he devoted many hours at home in the examination of the specimens exhumed. He even abridged his short holidays, and all idea of living in London was abandoned on this account." In the investigation, the surface accumulations having been removed and preserved for examination, the floor of granular stalagmite was stripped off, so as to lay bare the cave earth, and this was dug out ultimately to a depth of four feet in a series of prismatic blocks, a yard long and a foot square in section, layer by layer. This material was examined in the cave by candlelight, then at the door by daylight. A box was appropriated to each "yard," in which all the objects of interest found in that particular earth were put. The boxes, with the record of what they contained, were sent daily to Pengelly, who cleaned the articles and repacked them, and kept regular records of his day's works. Other materials were dealt with with similar thoroughness in ways according to their nature. "Whatever was discovered beneath the stalagmite flooring must have been sealed up by it for, at the very least, two thousand years, probably for a much longer time." The exploration was completed June 19, 1880. The more than seventy-three hundred prisms of material which proved productive yielded, besides fifty thousand bones examined by Prof. Boyd Dawkins, numerous implements, including those of bone, the work of man. Two deposits were evident, one of "cave earth," and one of breccia beneath it. A glance at the implements from them showed that they were very dissimilar. Those from the breccia were more massive and ruder in every way than the others, and none of them were of bone. "In short, the stone tools, though both sets were unpolished and coeval with extinct mammals, represent two distinct civilizations. It is equally clear that the ruder men were the more ancient, for their tools were lodged in a deposit which, whenever the two occurred in the same vertical section, was invariably the undermost." Various conditions in the deposits united in indicating that the interval between them must have been very considerable. Other caves were examined by Pengelly, but his most important discoveries were made in those of Brixham and Kent.

A third section of Pengelly's scientific work reviewed by Prof. T. G. Bonney in the summary he has added to Miss Pengelly's biography, from which we have quoted freely, includes miscellaneous papers on geology and kindred subjects, relating almost exclusively to the southwest of England. As a rule, the papers are comparatively short, being the fruits of researches which either did not demand a long time, or could be carried on at intervals as circumstances allowed, and appeared mostly in the transactions of local societies.

Pengelly was one of the prime movers and a leading spirit in the organization, in 1862, of the Devonshire Association for the Advancement of Science, Literature, and Art, at Plymouth, and was its president in 1867–'68. The objects of the association were "to give a stronger impulse and a more systematic direction to scientific inquiry in Devonshire, and to promote the intercourse of those who cultivate science, literature, or art in different parts of the country." It worked according to the methods of the British Association, with literature and art added to its objects, besides giving some attention to history and archæology. The first meeting was held under the presidency of Sir John Bowring. In 1872 the president was the bishop of the diocese, Dr. Temple, now Archbishop of Canterbury. In 1863 Pengelly was elected a Fellow of the Royal Society.

From 1856, when he read a paper at the Cheltenham meeting, Mr. Pengelly was almost a constant attendant upon the meetings of the British Association, and gained, as the years advanced, a prominent position among its leading members. He was president of the Geological Section at the Plymouth meeting, 1877. At the jubilee meeting of the association, held at York in 1880, he made the acquaintance of Prof. Asa Gray, which ripened into a friendship and resulted in a visit of Professor Gray and Mrs. Gray to Torquay. He met another distinguished American man of science, Prof. O. C. Marsh, recently deceased, at the International Geological Congress in London, in 1888. In 1891 he received a visit from Prof. G. F. Wright. He opposed the transference of the meeting of the British Association to Montreal in 1884, on account of the expense and the sacrifice of time which he thought many who would like to attend could not afford, and did not go himself. In

March, 1874, he was visited at Torquay by Professor Phillips and others in behalf of a number of members of the British Association, and presented with an illuminated parchment containing the signatures of the contributors and a check, as a testimonial "in recognition of his long and valued services to science in general, and more especially for the exploration of Kent's Cavern. Replying to the addresses, he said he had done the work in connection with Kent's Cavern simply because he liked it. . . . He had experienced intense pleasure in it, and he could assure them that, on his finding a *Machairodus latidus*, after seven years and a half exploration, the discovery of that one tooth, in his opinion, was worth all the money that had been spent in the exploration of the cavern."

Besides geology, Mr. Pengelly had a living concern with astronomy, on subjects of which he lectured and read papers, and in folklore, and was "extremely interested" in the religious history of Cornwall. He became a member of the Society of Friends about 1853, and married his second wife, Lydia Spriggs, in that body. She assisted him in his scientific work, preparing diagrams.

Of Pengelly's character as a man, Professor Bonney speaks of the great charm in his personality, and the union in him of "such strong mental powers, and no less strong sense of what was just, true, and right, to such genuine humor and hearty enjoyment of wit." Sir Archibald Geikie speaks of his "genial, kindly, and helpful nature, and his invariably bright, cheery, and witty talk." Prof. Rupert Jones characterizes him as "a good example of a religious man—earnest, persevering, and exact in scientific research." The Rev. Robert Hardy says, "He did not obtrude his theological opinions, but it was easy to perceive that he was a man of true religious character." Sir Joseph Lister, looking back to the times of his acquaintance with him, recalled "vividly the impression of his great intellectual powers, his genial benevolence, and his sparkling humor."

As a lecturer his style is described as having been "most attractive. It is incisive, clear, and at times there are touches of humor. His perfect knowledge of the subject, combined with intense earnestness, clothed his lecture with genuine eloquence."

Miss Pengelly's biography abounds with illustrations of her father's rare faculty of attracting and interesting workingmen. A letter from one such man expresses gratitude, mingled with great pleasure, for the lasting happiness he was "so anxious and constant to impart to us young men during the Young Men's Society and afterward at the Mechanics' Institute, . . . and I have often felt and said I owe more gratitude for the small amount of knowledge I possess, to Mr. Pengelly, of Torquay, than to any living man, and I think there are a few now in Torquay who might truly say so too."

Editor's Table.

KINDERGARTENIZED CHILDREN.

WE do not know whether the verb "to kindergartenize" has yet crept into the language, but, after reading the article of Miss Marion Hamilton Carter in the March Atlantic on The Kindergarten Child —after the kindergarten, one is disposed to think that such a verb is a present necessity. The question as to whether the kindergarten on the whole is a good institution is too wide for discussion within the restricted limits of the Table; but no one can read Miss Carter's article without being forced to the conclusion that, in some of its aspects, kindergarten work is of very doubtful utility. That lady found by actual experience with two or three successive levies of kindergarten children that they seemed to have an impaired rather than an improved faculty of acquiring knowledge, that their infancy seemed to have been artificially prolonged, that they had become accustomed to a nauseating amount of endearment in the language addressed to them by their instructors, that they seemed to expect to be continually amused, and that a certain drill through which they had been put for the alleged purpose of developing their powers of imagination had gone a long way toward making them incapable of speaking of things simply as they found them. All this is set forth in Miss Carter's article in a manner which leaves little doubt that she has described things substantially as they fell under her observation.

There is one important principle in education which it seems to us the kindergarten system too much ignores, if it does not completely set it at defiance, and that is that very young children require a great deal of letting alone. The spontaneous activity of the little ones—and they are sure to be active if they get the chance—is worth more for their education than any amount of directed activity. Their imaginations, too, will take care of themselves much better than we can take care of them. Nothing is less favorable to the development of imagination in a child than constant intercourse with grown people who have passed the imaginative stage, and whose daily duty it is to lay out ordered knowledge for assimilation by these babes. It is no wonder that part of the system should consist of special exercises for the cultivation of the very faculty which the system as a whole is so adapted to dull and to weaken. Anything much more silly, however, than the method described by Miss Carter it would be difficult to imagine.

The great popularity of the kindergarten is due in large measure to the fact that it relieves mothers during part of the day of the care of their small children. That it does this in very many cases at the expense of weakening the tie between mother and child there is too much reason to fear. The State has been stepping in more and more between parents and children, until now it lays its hand almost upon the cradle. The mothers of the republic are giving way, so far as influence over the rising generation is concerned, to the schoolmarms; but it is idle to expect that the latter can take the place of the mothers we used to know. The kindergarten constitutes a vast extension of the educational machinery previously in operation, and machinery is always impressive, especially to those who do not understand it. What people see is that the system works very smoothly and uniformly and rhythmically, and that it saves, or seems to save, them a great deal of trouble; and that it is enough to make them think it something very fine. Whether it is really saving trouble in the end is a question which we consider quite open to discussion. There is room, in our opinion, to inquire whether the stimulus of society is not too early and too systematically brought to bear on the infants who throng the educational nursery—whether it is well for children of three and four to be brought every day under the eye of, and more or less into competition with, a large number of companions of their own age. We doubt much whether it tends to simplicity of character, and we can not but regard it as distinctly unfavorable to the development of individuality. The rule of fashion begins at once to operate with great intensity, and the child loses the power of conceiving life except in the herd. As to whether trouble on the whole is being saved to parents by the new system, the question could best be answered by ascertaining whether, in the long run, parents have more or less trouble with their children now than formerly. We should be surprised to hear any one maintaining that they had less.

We are aware that parents, for the most part, enthusiastically testify that their children enjoy the kindergarten very much; but may it not be possible for children, as well as their elders, to like what is not altogether for their good? We do not consider that we can safely follow all a child's likes and dislikes in the matter of diet, or companionship, or hours for going to bed and rising. Sensible people do not think that everything children crave should be given to them, or that more than a limited number of excitements should be thrown in their way. It is one of the drawbacks to wealth that the possessors of it can hardly refrain from half burying their children beneath a profusion of toys, and crowding upon them such a multitude of distractions, in the way of travel, shows of all kinds, and society, that all chance of development from within is well-nigh destroyed. It has been remarked by many that the children of to-day who rarely read a story that is not illustrated, have much less imagination than the children of former days, who in reading had to make and did make their own mental pictures. Yet what pampered child ever said he or she was pampered too much? What overflattered child ever asked for a surcease of flattery? What child suffering from an excessive amount of social excitement ever requested that it might have less of such unhealthy stimulation? The inference we draw is that it does not settle the question finally in favor of the kindergarten to say that children enjoy it. If Miss Carter's experience is to be depended on, the result at least of some kindergarten training is to stimulate the vanity of the little ones and give them a quite undue sense of their self-importance. They would enjoy that while it lasted, poor little things! but it would be a bad preparation for the subsequent work of education. One broad fact stares the educational world in the face, and that is that the average child has to-day, at a given age, a less capacity for learning than the average child of twenty-five or thirty years ago. What share the kindergarten may have had in this retardment of intellectual development is a question which deserves investigation. Messrs. McLellan and Dewey, in their work on The Psychology of Number (International Education Series), say (page 154): "We have known the seven-year-old 'head boy' of a kindergarten, conducted by a noted kindergarten teacher, who could not recognize a quantity of three things without counting them by ones. . . . There is surely something lacking either in the kindergarten as a preparation for the primary school, or in the primary school as a continuation of the kindergarten, when a child, after full training in the kindergarten, together with two years' work in the primary school, is considered able to undertake nothing (in arithmetic) beyond the number twenty." These authors enter into a very elaborate analysis of the number concept, and lay down with extreme care what they conceive to be the best lines of approach to the youthful mind in the teaching of arithmetic. It seems to us, however, that the number concept will dawn upon the youthful mind without much effort on the part of teachers when the time arrives for it to be of use. In most childish games the element of number is involved. The smallest girl with a skipping rope will get into the way of counting her skips with a more or less distinct conception of the difference between one number and another. So in the matter of "turns" in any game in which two or more are engaged: if one child wants to have more "turns" than it is entitled to, the others have to be very young indeed not to protest. In a tug-of-war with, say, four on each side, the addition of a fifth to one side without permission would make trouble in the camp. When candies are being distributed the arithmetical sense is generally keenly alive.

We conclude by commending Miss Carter's article to the careful consideration of all who are interested in educational problems. She writes with a certain tinge of vexation, and, without meaning it, may have somewhat forced the case against her kindergarten children. The Atlantic Monthly deserves credit, we must add, for the many able and timely articles which it has lately been publishing on educational topics—articles stamped by the breadth of thought and high culture which are characteristic of our contemporary, and eminently adapted to assist in delivering our educational methods from bondage to a mechanical routine, and bringing them nearer to the simplicity and freedom of Nature.

IS FREEDOM LIMITED BY CLIMATE?

Since the United States turned its ambition toward the tropics, the question as to whether its political institutions can be extended to the inhabitants there has been widely discussed. As might be expected, the philanthropic advocates of expansion have insisted that "the blessings of freedom and civilization" are not limited by latitude or longitude. Any other position would, of course, have involved them in the charge of inconsistency and hypocrisy. But certain philosophic expansionists, as they may be politely called, have taken the opposite view. "It is a cardinal fact," they say, quoting the language of a recent essay of Mr. Benjamin Kidd, "that in the tropics the white man lives and works only as a diver lives and works under water. . . . Neither physically, morally, nor politically can he be acclimatized in the tropics." Still quoting his language, they say again that "a clearer insight into the laws that have shaped the course of human evolution must bring us to see that the process which has gradually developed the energy, enterprise, and social efficiency of the race northward, and which has left less richly endowed in this respect the people inhabiting the regions where the conditions of life are easiest, is no passing accident, nor the result of circumstances changeable at will, but part of the cosmic order of things which we have no power to alter."

Whether Mr. Kidd recognizes the odious significance of his captivating speculation or not, it is certainly a plea and an apology for slavery and political despotism in the tropics. Most welcome will it be to all those nations and people of easy conscience and measureless greed that now hold in bondage of greater or less intensity millions of the inhabitants of that rich and splendid region. But there is reason to believe that it must be relegated to the limbo of a kindred and popular superstition. Within the past year much has been said about the genius of the Anglo-Saxon for freedom and the ethnic incapacity of the Latins for that boon of civilization. Even so great a scholar as Guizot encourages this extraordinary theory. Again and again does he point out in his History of Civilization how the spirit of freedom may be traced to the Teutonic hordes that swarmed the forests of Germany. He does so despite the overwhelming evidence against him to be found in his own pages even. In apology for his misinterpretation of social phenomena there can be urged his ignorance of the law of evolution and of the hardly less important law of the militant origin of despotism and the pacific origin of freedom. No such apology can, however, be made in behalf of Mr. Kidd, or of any other apostle of imperialism. Not only have they at command all the generalizations of social science, but all the facts upon which those generalizations are based, to prove that neither climate nor race is a limitation upon freedom.

If climate determined the character of the political institutions of a people, many questions would be suggested at once that would be beyond solution. Why, for instance, should a certain freedom have existed in Athens, and the most intolerable despotism in Sparta? Again, why should there be despotism in Russia and Germany as well as in Morocco and Egypt? Another series of questions equally perplexing can be raised. Why should there be more freedom in England to-day than six hundred or even one hundred years ago? The climate has not changed in the interval. Why should the institutions of Spain in the thirteenth century have been more liberal than in the seventeenth? Why was it that the freedom that existed in Germany before the Thirty Years' War had virtually ceased to exist at the Peace of Westphalia? Here also the climate had not changed. Why, finally, was there a reaction toward despotism in France after the French Revolution, in Germany after the disturbances of 1848, in England after the Crimean War, and in the United States after the rebellion? The only satisfactory answer to these questions is to be found in the fact that militant activities always lead to despotism, and pacific activities always to freedom. When people get into war, the central power must exercise all the authority over life and property essential to success in battle. The impulse thus given to despotism spreads to every part of the social fabric. When people are devoted to the pursuits of peace, the forces that make for freedom transform their ideas, feelings, morals, and institutions, political, industrial, and social.

Whether despotism exists, as Mr. Kidd and his followers assume, among all the indigenous populations of the tropics, only a careful investigation of the subject would permit one to say. But that it must, as they contend, always exist there, none of the laws of social evolution gives the slightest warrant. Wherever it does exist, it had the same origin that it had in England, and in obedience to the same forces of peace and industry that operated against it in that country, it must pass away. The struggles between clans and tribes for the possession of desirable territory, or for the capture of food or slaves, or for the gratification of predatory and belligerent instincts, gave rise to the permanent chief, to the ruling hierarchy, and to all the other characteristics of a militant society. The degree of heat or humidity or the luxuriant vegetation of the tropics had no more to do with this political organization than the degree of cold, or the dryness of the atmosphere, or the comparative poverty of the soil of some of the Western States with the similar political organization of the Indians that roamed over them. None of these physical characteristics can prevent the play of those forces that drive people eventually to the adoption of that form of social organization that will best promote their happiness. As the social philosophy of evolution shows, the social organization best fitted for this purpose is the one where the largest individual freedom prevails. Since the abolition of slavery and serfdom and many other forms of despotism has been found necessary for the best interests of society in Europe, we have a right to believe that the abolition of the same forms of despotism will be found necessary for the best interests of society in the tropics.

It is true that in the tropics the white man has found it uncomfortable to work, and has often reduced the indigenes to a kind of slavery. But that either is inevitable and unavoidable because of the laws of social evolution, or any more than a temporary reversion, there is no reason for holding. Alfred Russel Wallace, who spent twelve years in the tropics, says in a recent article that the white man can and does work in every part of them. If he does not work, it is simply for the same reason that he does not work in Europe or the United States—namely, because he does not have to. When, however, necessity lays its heavy hands on him, driving him to earn his living by the sweat of his brow, he does it in the tropical region quite as well as he does in the temperate. That is shown particularly in Queensland. But when natives can be reduced to slavery the crime is committed with slight compunction, and defended on the same ground that it was defended in the South and elsewhere. The time must come, however, as it came in Brazil and in other countries where slave labor was found too wasteful and demoralizing, when it will be displaced with free labor. The time must come, too, when free institutions will be found as essential under the equator as farther north. Without them social evolution can not reach its highest point, nor man attain to his greatest happiness, a state that he is always seeking, no matter where he lives.

Scientific Literature.

SPECIAL BOOKS.

The famous discovery in Java, by Dubois, of the skullcap, femur, and two teeth in the upper Tertiary rocks has led to many interesting discussions, among which was a paper read by Ernst Haeckel before the International Congress of Zoölogists, held in Cambridge, England, last year. In this paper Haeckel contended that in these remains we had at last the long-sought-for missing link.* This paper excited much interest,

* The Last Link. Our Present Knowledge of the Descent of Man. By Ernst Haeckel. Adam and Charles Black. 1898.

which led to a request for its publication. The intelligent public, without knowing much about the value of the osteological points under discussion, were ready to grant that here indeed was the missing link, since the highest authorities in science were divided in opinion as to whether the remains belonged to a very low member of the human race or a very high member of the manlike apes. The conclusion would naturally follow that it made but little difference whether the remains proved to be those of man or monkey, as here was a creature so intermediate in structure that it stood on the dividing line, so to speak. In this little book Haeckel presents the old evidences as to the structural similarities between man and the higher apes, and places the Java remains (*Pithicanthropus erectus*) as the last link in the chain of descent. He also traces the ancestors of the apes through the mammalian series down, step by step, to the lowest vertebrates, and on through the invertebrates to the lowest forms of life. The suggestions are in many cases hypothetical yet instructive, as showing the possible lines of descent.

The unaccountable attitude of the distinguished Virchow in the presence of these remains is in harmony with his uncompromising and, one might say, unreasoning attitude in regard to the derivative theory. Haeckel shows this up very clearly in the following, which we quote: "Virchow went to the Leyden Congress with the set purpose of disproving that the bones found by Dubois belonged to a creature which linked together apes and man. First, he maintained that the skull was that of an ape, while the thigh belonged to man. This insinuation was at once refuted by the expert paleontologists, who declared that without the slightest doubt the bones belonged to one and the same individual. Next, Virchow explained that certain exostoses or growths observable on the thigh proved its human nature, since only under careful treatment the patient could have healed the original injury. Thereupon Professor Marsh, the celebrated paleontologist, exhibited a number of thigh bones of wild monkeys which showed similar exostoses, and had healed without hospital treatment. As a last argument the Berlin pathologist declared that the deep constriction behind the upper margin of the orbits proved that the skull was that of an ape, as such never occurred in man. It so happened that a few weeks later Professor Nehring, of Berlin, demonstrated exactly the same formation on a human prehistoric skull received by him from Santos, in Brazil."

Mr. *Russell* expresses a hope that the review of some of the characteristics of rivers given in one of the chapters of his *Rivers of North America* * may stimulate a desire in American students "to know more of the many and varied charms of their native land." The study of rivers is an alluring one, whether pursued upon the little local stream of one's neighborhood or upon the grand rivers that form systems and determine geographical districts; whether made with the assistance of a fishing-rod or of a steamboat. It can not fail to be promoted by Mr. Russell's instructive book, which the local student or the excursionist may consult with profit, while the geographer and geologist will find it a convenient manual. A river, when we come to think of it, means a great deal. Economically, it is the most valuable topographical feature a country can possess; geologically and geographically, it is a result of prominent features of the earth's structure, and is the cause of modifications in its surface which in time

* Rivers of North America. A Reading Lesson for Students of Geography and Geology. By Israel C. Russell. New York: G. P. Putnam's Sons. Pp. 327. Price, $2.

may revolutionize the topographical conditions and produce climatic and physical changes. All these characteristics of rivers are systematically and comprehensively set forth in Mr. Russell's book, where the life-history of the stream is presented, from its beginning in a little mountain torrent or hillside rill, through its course as it descends to the plain, wearing and tearing and deepening its channel. In the plain its character and action are modified under the new conditions in which it finds itself, and gradually, as it approaches its mouth, it deposits, whereas it had torn away at its beginning, and shows contrasts quite as marked as those between youth and old age. Rivers have their growth in time, too, and a stream that has been carrying on its work for long ages presents different characteristics throughout its course from one that comes fresh to its task, and these differences are pointed out. We are told, too, how rivers grow, drawing new affluents to themselves and extending their sources backward, and how when the sources of streams on different sides of a watershed approach on the summit, there is a struggle for the mastery. These are only a few of the new suggestions which the book offers us. Coming to the more matter-of-fact details, the laws governing streams and their course; the influence of inequalities and the hardness of rocks, especially on riverside scenery; and the office of rivers as carriers of material in suspension and in solution, are considered; then their deposits, under various heads and aspects, and the effects of changes in the elevation of the land, of variations in the load of material and of changes of climate upon them; the origin and characteristics of stream terraces and stream development, the topics concerning which are too many and varied to bear more than a passing reference. The more salient characteristics of American rivers are discussed as to the nine drainage slopes—the Atlantic, St. Lawrence, Hudson Bay, Arctic, Bering, Pacific, Great Basin, Gulf, and Caribbean—each slope presenting its own general characteristics, with varieties in detail almost as numerous as the rivers. The whole is briefly summarized in the last chapter, The Life History of a River. We have given merely the tamest inventory of only a part of the topics of Mr. Russell's book. As the subject is treated by the author with careful attention to specific features, as the magnitude of our river systems is indicated, and as rivers with different or contrasting characteristics—the St. Lawrence and the Colorado, for example—are compared with one another, the subject takes on an aspect that is really grand.

GENERAL NOTICES.

An unfulfilled intention entertained by two successive prosectors of the London Zoölogical Society—the late Professor Garrod and the late W. A. Forbes—of writing a treatise on bird anatomy, is carried out in the present work * by their successor, *Frank E. Beddard.* Professor Garrod had nearly completed an account of the Anatomy of the Fowl, which was to be followed by a presentation of the anatomical characters of the different groups. Professor Forbes died before he was able to add anything to the manuscripts left by Professor Garrod. In the instance of the present work the detailed account of *Gallus*, with which Professor Garrod intended to preface his book, has been rendered unnecessary by Dr. Shufeldt's monograph on the Raven, dealing with one particular bird type. Accepting this as a sufficient presentation of that feature of the subject, Mr. Beddard begins with a general sketch of bird structure, purposely avoiding histological detail and the elaborate description of anatomical facts, which in the present state of our

* The Structure and Classification of Birds. By Frank E. Beddard. London and New York: Longmans, Green & Co. Pp. 548.

knowledge are not of great use in classification. The main part of the book is the account of the structure of the different groups of birds, which is treated of to a considerable extent; and a large number of facts, some of which are recorded for the first time, are incorporated in the systematic part of the book. While all the principal facts pertaining to the subject are believed to have been given, and nothing of importance to have been left out, references are made in each section to most of the memoirs already published. The majority of the facts of bird structure have been verified by the author, especially those relating to osteology and anatomy, and he has drawn liberally on the notebooks of his two predecessors. The book gives first an account of the general structure of birds; next of the reproductive and renal organs, the circulatory, respiratory, and muscular systems, osteology, brain and nervous system, and affinities of birds, and, finally, the classification.

Bush Fruits * is the first of a proposed series of monographs on the various types of American fruits, to be published under the editorial direction of Prof. L. H. Bailey. Its purpose is to present both the practical and the technical phases of all the important questions concerned in the cultivation and domestication of the fruits that grow on bushes; and the attempt is made to present these two sides separate from the details of history, botany, and entomology, so that the practical reader may be introduced at once to the information he is seeking. The aim is made to treat general truths and principles rather than mere details of practice, leaving the reader to think out and solve the local problems for himself. The author, Mr. *F. W. Card*, who presented the work originally as a Cornell University thesis, was first a bush-grower, and then a student and teacher, acquiring first the practice and then the theory. The fruits treated of are raspberries, blackberries, dewberries, currants, gooseberries, buffalo berry, gounie, huckleberries, Juneberries, the cranberry, barberry, and sand cherry—all, as to their important types, except the currants, evolutions from the species of our own woods. A useful list of American books on bush fruits is given in the appendix.

*The History of the World, from the Earliest Historical Time to the Year 1898,** is the latest addition to the Concise Knowledge Library, "a series of volumes on great subjects, containing in an abridged form a wealth of exact information which can be thoroughly relied upon by the student, and yet of such a popular character as to meet the needs of the general reader." This compact volume of 790 pages presents a complete survey of the world's history. After a brief introduction describing the various races that have furthered civilization, ancient history proper begins with the Egyptians, the people of whom we possess the earliest records, and who were the first to emerge out of the darkness of prehistoric times. Closely connected with them, both by racial affinities and political ties, were the other great empires in the southwestern part of Asia that one after the other rose, flourished, and fell into decay. The interesting part of the book here is the constant reference to the familiar facts of the Bible, the connection of the known with the unknown. The rise and development of Greece and Rome, following in due course, bring us down to the middle ages. Mediæval history has for its stage Europe, and for its argument the upbuilding of the states on which our modern political institutions rest. Modern history, dating from the discovery of America, then turns the eyes of the nations westward, to found empires beyond the sea. Nor is the East forgotten. Asia, the cradle of man, and Africa, where he first rose into consciousness of himself and recorded his deeds, again claim the historian's attention. But now it is China and Japan on the one continent, and the conquests and colonies of the Europeans on the other. Neither is the country youngest in civilization, Aus-

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* Bush Fruits. A Horticultural Monograph of Raspberries, Blackberries, Dewberries, Currants, Gooseberries, and other Shrublike Fruits. By Fred W. Card. New York: The Macmillan Company. Pp. 537. Price, $1.50.

* The History of the World, from the Earliest Historical Time to the Year 1898. By Edgar Sanderson. With Maps. New York: D. Appleton and Company. 1898.

tralasia, passed by. And the history of all these countries, whether east or west, is brought down to date. Even our recent war with Spain is briefly told. Indeed, the value of the book as a work of reference lies in the fact that it encompasses *all* the world's history, giving in compact, handy form the chief data in the progress of the human race, that otherwise must be sought for in a dozen different places. Another valuable feature of the book, attainable only on the plan of rigid selection of salient points, is the connection between the different peoples. Their interdependence, the sequence of their appearance on the stage of action, and their decline, are most vividly realized in such a bird's-eye view. The book has maps and a full index.

The essays comprised in Mr. *William M. Bryant's* volume entitled *Life, Death, and Immortality, and Kindred Essays* * have developed, as he expresses it, one by one during a number of years past. The term developed is a happy one, for the papers were certainly not made to order, but read like results of systematic, continuous thinking. They concern the religious aspect of human nature. The author thinks that negative criticism has for the time being exhausted its resources, and the time has come for further positive interpretation of the fundamental conceptions of the Christian doctrine as to man's nature and destiny. A reference to a few of the points in the first essay, which gives the title to the book, will afford a view of the author's method. Men of science are constantly insisting that the total quantity of energy is changeless, and nothing can be added to it and nothing taken away. What are the "total quantity of energy" and the "great first cause" but the same, to the activity of which is due every phase of reality? This being changeless, it could not at some period "have created a world and afterward left it to spin on of its own accord 'without interference.'" Mind is a form of energy, consequently indestructible and undying, and the question of immortality is reduced to the form "whether in respect of man's essential nature as a thinking unit, death can ever be more than transition from one to another grade of life." Other essays are on Oriental Religions, Church Organization, The Heresy of Non-Progressive Orthodoxy, Christian Ethics and those of other religions, and Eternity.

Professor *Merriman's Elements of Sanitary Engineering* * is a thoroughly practical treatise setting forth the principal rules and laws relating to sanitation, both individual and municipal, as it is practiced to-day. A brief historical introduction is followed by a classification of diseases, and a general consideration of such questions as filth and disease, impure air and disease, drinking water and disease, etc. The second chapter takes up the question of the purification of water. Chapter III discusses the practical aspects, for a municipality, of water-supply systems. Consumption of water, capacity of storage reservoirs, pipe lines, pumping engines, tanks and stand pipes and street mains are among the special headings. Sewerage systems are next dealt with. A discussion of questions connected with the disposal of garbage and sewage forms the fifth and last chapter of the book. An item which adds value to the volume is the series of exercises and problems, practically applying the laws set forth, which follows each chapter.

An Epitome of Human Histology † has been written by Mr. *Weysse* to meet the difficulty in which the conscientious student of microscopic anatomy is placed who finds himself in possession of a great many isolated facts about the minute structure of the body, but with rather an indefinite conception of the relation of those facts to one another and of the subject as a whole. In the writing the author has sought to present all the facts that are of real importance to the student; to express them in the briefest and clearest language, omitting whatever is not strictly required; and to arrange them in such

* Life, Death, and Immortality, and Kindred Essays. By William M. Bryant. New York: The Baker & Taylor Company.

* Elements of Santary Engineering. By Mansfield Merriman. New York: John Wiley & Sons. London: Chapman & Hall, Limited. Pp. 216. $2.

† An Epitome of Human Histology. By Arthur W. Weysse. New York: Longmans, Green & Co. Pp. 90. Price, $1.50.

a way that the reader, in considering any organ, may, if he will, actually sketch each part as he proceeds, and thus make a diagrammatic plan or picture of the entire structure. The book is not for idle students, but for serious ones, and it is not a text-book or intended to take the place of one; and it can serve its true purpose only when used by students who have had laboratory practice as well as lectures in histology, and have thus examined the actual structures.

In his work on *Elementary Botany*,* Professor *Atkinson* introduces the method which he has found successful in teaching beginners. Many of the newer botanical text-books, in reacting against the plan of presenting first the higher types of plant life, overwhelm the student not only with a multitude of unfamiliar forms, but demand from him powers of comparison and analysis that are generally the result of much scientific discipline. In this book the pupil receives some preliminary guidance in habits of correct induction. By studying the processes of transpiration, nutrition, growth, and irritability in plants belonging to higher as well as lower groups, he learns the universality of these life principles, and is led to see the foundations for sound generalization. This the author considers vastly more important than the knowledge of individual plants. The student, however, in this investigation becomes acquainted with special forms among the lower plants, and is thus prepared to take up morphology systematically. This topic begins with the study of Spirogyra, and ends with an outline of twenty lessons in the angiosperms. The final third of the book is devoted to ecology, the study of plants in their natural surroundings and of their modifying factors—climate, soil, topography, etc. The illustrations, which are above the average throughout the work, are in this division exceedingly good. The descriptive text of the same section is entertaining enough to be used as a class reader, and would interest those unfamiliar with botany. There are several slight errors to be corrected in a future edition. In the table of measures a kilometre is made to equal one hundred instead of one thousand metres, and the references to plates are occasionally wrong. On page 345 the reference should be 449, and on page 349 should be 458 in place of 457. In describing pollination of the skunk cabbage, the words "rub off" are ambiguous. The uninitiated might suppose that the insect obtained pollen from the stigmas instead of depositing it there. The book is not intended for recitation, but for reference and as a guide in study. It is supplied with an appendix upon the collection and preservation of material, and an index.

* Elementary Botany. By George Francis Atkinson, Ph. B. New York: Henry Holt & Co. Pp. 444. Price, $1.25.

A notice of a book * of this nature is justified in this column, since it contains much that will be of interest to the student of ethnology, folklore, and cognate subjects. It is interesting to get a glimpse of matters pertaining to social customs, ways of thinking, and the occurrences which animated these ways among the Japanese a thousand and more years ago. The author says, "It is a remarkable and, I believe, an unexampled fact that a very large and important part of the best literature which Japan has produced was written by women."

The preparation of his *Elementary Text-Book of Botany* † was undertaken by Mr. *Vines* to meet a demand which appeared to exist for a less bulky and expensive volume than his Students' Text-Book. A more important feature than the diminution of the bulk is claimed in the simplification which the contents have undergone from the omission of certain difficult and still debatable topics. The usual divisions into morphology, anatomy, physiology, and systematic botany are followed; but the caution is appended that it must not be forgotten that these are all parts of one subject, different methods of studying one object—the plant. Hence they must be pursued together. "For instance, the morphology of the

* A History of Japanese Literature. By W. G. Aston, Late Japanese Secretary to H. M. Legation, Tokyo. D. Appleton and Company.

† An Elementary Text-Book of Botany. By Sydney H. Vines. London: Swan, Sonnenschein & Co. New York: The Macmillan Company. Pp. 611. Price, $2.25.

leaf can not be profitably studied without a knowledge of its structure and functions; and it is also important to know what is the systematic position of each of the various plants whose leaves afford the material for study. In a word, the student should not attempt to read the book straight through from the beginning as if it were a novel. On the contrary, he may begin with any one of the four parts as his main subject; but that part must be studied in close relation with the other three parts"; and this method of proceeding is facilitated by the insertion of a large number of cross-references in the text.

A satisfactory account is given by *C. Francis Jenkins* in *Animated Pictures* * of the development and present state of chronophotography, or the art of "conveying by persistence of vision a counterfeit impression of objects in motion through the display in rapid succession of a series of related pictures." The story shows very clearly that this, like most other inventions of consequence, is no sudden discovery, but is the culmination of a very long series of experiments. The principle of it is embodied in the toy, the zoetrope, the origin of which is not known, though a citation from Lucretius indicates that something of the kind existed in his time. With the discovery of instantaneous photography, a new application of the principle of the zoetrope was found. Muybridge and Marey were pioneers in this development with their photographs of the motions of animals valuable in sciences. Since their work was begun the photographic processes and apparatus have been greatly improved. Mr. Jenkins forecasts a brilliant and useful future for the art, which he hopes will be prosecuted along the line of other than its present most popular uses. The book is practical as well as historical and prophetic, and contains an account of Mr. Jenkins's phantoscope as the first successful "moving picture projecting apparatus," for which he received the Elliott Cresson medal from the Franklin Institute.

* Animated Pictures. An Exposition of the Historical Development of Chronophotography, its Present Scientific Application and Future Possibilities, and of the Methods and Apparatus employed in the Entertainment of Large Audiences by Means of Projecting Lanterns to give the Appearance of Objects in Motion. Washington, D. C.: C. Francis Jenkins. Pp 118, with plates.

The Metric System of Weights and Measures, prepared by Mr. *A. D. Risteen*, and published by the Hartford Steam-Boiler Inspection Company, Hartford, Connecticut (price, $1.25), gives what has long been wanted—a neat volume, convenient for the pocket and durably bound, furnishing tables for instantly converting all the metrical units up to one hundred of each into those of the English weights and measures, and *vice versa*. Calculation, being needed only for the numbers above one hundred, for which there are already short devices, is reduced to the lowest possible limit.

Terrestrial Magnetism, an international quarterly journal, edited by *L. A. Bauer* and *Thomas French, Jr.*, and published at the University of Cincinnati, is the recognized organ of the International Conference on Terrestrial Magnetism and Atmospheric Electricity. The September number, 1898, contains the proceedings of the conference, which met in connection with the last Bristol meeting of the British Association. It contains in full the welcoming address of Prof. W. E. Ayrton, the opening address of A. W. Rücker, president of the conference, and ten of the papers read at the meeting.

The name of Prof. *John Trowbridge* as author of such a book as *Philip's Experiments; or, Physical Science at Home* (D. Appleton and Company, $1) is a sure guarantee of its scientific value. The author has given a chapter substantially out of his own experience, for he says his taste for science and for drawing were stimulated by his father in the manner here described. His object in publishing it is "to show that a few moments devoted each day at home to simple investigations can result in habits of self-reliance in the acquirement of a modern language and in the study of the art of drawing." He endeavors also to show how to cultivate a taste for mathematics by studying practical problems in surveying and in sailing a boat; and how much a parent can accomplish in the formation of a son's tastes without special knowledge, and without the expenditure of much time and money.

The account is in the form of letters from the father to a friend, describing his experiments with his son Philip in this method of teaching. He has always cultivated fellowship with the boy; and, finding him inclined to improve and add to the designs on the wall-paper, puts objects to be drawn and copied in his way, and induces him to go out and draw from Nature. So the boy learns to study forms and observe. To teach language he gives him regularly the daily German newspaper, to pick out what he can from it, and joins him in the sport. In a similar way he introduces Philip to surveying and physics, and other branches of science. The plan is a success; Philip attracts attention by the ingenuity which his training has enabled him to develop, and going to college is graduated with credit and in possession of a live as well as a book knowledge of what he has studied.

In *The Story of the English* (American Book Company) the more prominent facts of English history from the beginning to the present time are related by *H. A. Guerber* in simple, brief narratives. A commendable feature of the book is the insistence in the preface of the essential oneness of the English and American people—an idea that can hardly be too sedulously cultivated. The author's principal object has been to render pupils so familiar with the prominent characters of English history that they shall henceforth seem like old acquaintances, and, in addition, to make the story attractive; but it is a fact to be regretted that he has regarded the growth of English law and liberty and the changes in religion as too unintelligible and uninteresting to be more than touched upon "very briefly and in the most simple way." The growth of law and liberty are the very things that it is most important to fix the attention of children upon, and it is only because they have suffered comparative neglect in the education of teachers in favor of stories of war and intrigue that they are not the most intelligible and interesting branch of the subject.

Prof. *Francis E. Nipher*, of Washington University, having been called upon to present a paper to an educational convention on the Greater Efficiency of Science Instruction, undertook to show how such changes as were adapted to promote that end might be accomplished without radical departures from present methods; and the *Introduction to Graphical Algebra* (Henry Holt & Co., New York, 60 cents) is the result of that effort. The author believes that the study of algebra and geometry as distinct subjects having no relation to each other gives the pupil a false idea of the intellectual situation of to-day; that by injecting here and there into the ordinary instruction in algebra such material as is found in his book, new meaning will be given to the operations involved in the solution of equations, and new interest in the subject may be aroused; and that as scientific investigators are making much use of other methods than Euclid's, while the study of his geometry should not be banished from our schools, some of the time given to it might be usefully spent in elementary analytical geometry or graphical algebra. The treatise is brief and convenient in size and composed in clear language.

The New Man, a Chronicle of the Modern Time (Philadelphia: The Levytype Company), is a story written by *Ellis Paxson Oberholzer* with reference to that expansion of women's education and sphere of action which is suggested by the phrase "the new woman." In it "the new woman is developed to her logical conclusion, and the new man as he must needs become under the reaction of her influence," and it deals with "men and women imbued with the modern university spirit, whose emotional natures are developed under the scientific impulse of our time, and whose thoughts and actions reflect that impulse in the midst of all the varied realities of our modern life."

Armageddon (Rand, McNally & Co.), to the plot of which the author's name of *Stanley Waterloo* seems curiously appropriate, is possibly a specimen of a class of literature to which we are likely to be treated in abundance for a few years to come. The spoliation of the Spanish Egyptians by the Americans having come to a halt with the gain of Puerto Rico and the Philippines, the great Anglo-American alliance enters upon the view and is made a fact, though informally. The two nations together build the Nicaragua Canal, and are about to celebrate its completion, when they are anticipated by the precipitation of the war of the nations through the simultaneous occurrence of a number of slight international quarrels in different parts of the world. Germany, Russia, the Scandinavians, and the Latins are pitted on one side, and the British and Americans, assisted by the British colonies and the Japanese, on the other; and the battle of the combined fleets occurs near the Canaries. The hero of the story has invented an air ship which carries terrible explosives to be dropped from a great height into the midst of the enemy. This engine does its work at the decisive moment, and then follows the grab game of negotiations, in which might rules, and Germany joins the Anglo-Saxon alliance against the rest of the world. Finally, the air-ship engine of destruction has rendered war henceforth forever impossible.

Mr. *James Reid Cole*, president of a classical and military school at Dallas, Texas, has published under the title of *Miscellany* what is substantially a picture or transcript of his own life. It contains a variety of articles—literary essays, school addresses, and even schoolboy compositions—the chief interest of which is to the author and his close friends. Other papers, such as A Bird's-eye View of Johnston's Surrender, the sketches of the Life of Lieutenant C. C. Cole, the Looking Backward over the course of the author's own life, and political and legislative speeches may have a more general value as partial reflections of the times to which they relate, more intimate than are usually to be derived from ordinary sketches and histories.

The publications of the *New York Academy of Sciences* now consist of two series—the *Annals* (8vo) and the *Memoirs* (4to). The Transactions, in which the shorter papers and business reports have hitherto appeared, are abolished, and the matter appears in the Annals. This publication, which was begun in 1824, contains the scientific contributions and reports of researches, together with the reports of meetings. The complete volumes will hereafter coincide with the calendar year. Vol. X, Nos. 1 to 12, contains three papers by H. S. Davis and one by Frank Schesinger based on the Rutherfurd photographs of the stars; The Nature and Origin of Stipules, by A. A. Tyler, and an examination of the Ascidian Half-Embryo, by H. E. Crampton, Jr. Vol. XI, Part II, contains the annual address of retiring President J. J. Stevenson, February 28, 1898, on the Debt of the World to Pure Science, and six articles on special subjects in biology.

The Commissioner of Labor was authorized by Congress in 1895 to make an investigation, so far as it could be done within the limits of the regular appropriations to his department, relative to the economic aspects of the liquor traffic. He interpreted such an investigation to include the consideration of monetary conditions; of the agricultural and other products used in the production of liquors; of the manufacture of liquors as a distinct industry; of transportation, consumption, and the traffic in them; of the revenue derived from them and the laws regulating its collection; and of the experience and practice of employers in relation to the use of intoxicants. In some of these phases of the subject the facts were not separable from those relating to other matters; in others, they were to be found in the reports of other departments; and original inquiry was necessary only with reference to the last three items of the category. The results of this inquiry are given in the *Twelfth Annual Report of the Commissioner of Labor, 1897*, under the heading of *Economic Aspects of the Liquor Problem.*

A New Story of the Stars is an essay in which *A. W. Bickerton*, professor of chemistry and physics in Christ Church College, New Zealand, sets forth a theory of the origin of universes or of parts of universes by impact. Nebulæ already existing—but how existing we are not informed—careering through space, are supposed to collide, whereby heat and light are developed. They may meet in face, and would then probably coalesce, but more likely the impact would be a grazing one, when three bodies would be produced; a portion, or slice, as the author calls it, of each of the colliding bodies would be sheared off, forming an intensely hot and bright new star, while the original masses would go on their course, having the parts that had been in contact heated and made brilliant, so as to present in their revolutions the aspect of variable stars. The author's attention was drawn to this subject by the appearance of a new star in Cygnus in 1877. A little while afterward Nova Aurigæ appeared, presenting exactly the phenomena he had predicted. Professor Bickerton writes as one who understands his subject; there is nothing in his speculations, so far as we have observed, that grates harshly with known facts, and it can be read, as he reads it, to account plausibly for some of the facts—just as can several other theories of the formation of the universe which are still only speculations. The problem is yet far from comprehension, and is one of the legacies which the nineteenth century is destined to bequeath to the twentieth. (Published at Christ Church, New Zealand.)

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Fragments of Science.

Death of Professor Marsh.—Othniel C. Marsh, professor of paleontology in Yale University, and curator of the geological collection of that institution, died of pneumonia at his home in New Haven, Connecticut, March 18th. He had not been in good health for several years, and succumbed to the effects of a cold which he had caught before wholly recovering from a previous cold. A sketch of his life up to that time, embracing the most active parts of his career as a geological explorer, in which he gained great renown, was given, with a portrait, in the Popular Science Monthly for September, 1878. During the period that has intervened he made studies of the results of his explorations and other geological work, and published papers of very high scientific value. About a year ago he transferred his extensive and famous collections at the Peabody Museum to the university. These collections were among the finest of their kind in the world, and were especially remarkable for their fossils of immense animals exhumed from the Western plains. They were greatly admired by Professor Gaudry, the eminent Erench geologist, who spoke of them in terms of high praise in the *Revue des Deux Mondes* of October 15, 1898. It was through his efforts that the funds were obtained from George Peabody, his uncle, for the construction of the Peabody Museum, a part of which has been built. His health having apparently improved for a few months previous to his death, he had been working with renewed activity at the museum, and had recently written articles on paleontological subjects. Having considerable means of his own, he served the university without salary, and carried on his explorations mostly at his own cost, paying large sums to assistants and for other items in the work. He left ten thousand dollars to the National Academy of Sciences, of which he was one of the founders and was for several years president, and all of the rest of his estate, estimated to be worth nearly one hundred thousand dollars, to Yale University.

Popular Co-operation in Health Work.—In a review of A Quarter Century of Public Health Work in Michigan, Mr. Theodore R. MacClure, chief clerk of the State Board of Health office, says that experience in the State has indicated that it is necessary to have the co-operation of the people if the dangerous communicable diseases are to be restricted and prevented. In order to accomplish this result, the State Board of Health has published leaflets relating to the modes of spreading and the best methods for the restriction and prevention of such diseases. These leaflets have been printed by tens of thousands, and whenever a dangerous disease is reported to the central office several copies of the leaflet relating to the disease in question are usually sent to the local health officer. He is requested to place one of these instructive publications with the family where the disease exists, and a copy with each neighbor of the infected premises. The instruction comes at a time when people are interested to know about the disease in question, and in this way their general co-operation is sought and secured. Citizens are thus educated and become familiar with their duties in the premises, are taught wherein the dangers lie and how to avoid them, and are prompted by the strongest considerations to do their part in the matter.

Death of Prof. Oliver Marcy.—Dr. Oliver Marcy, professor of natural science in Northwestern University, who died February 19th, in the eightieth year of his age, was a native of Coleraine, Massachusetts; was graduated from Wesleyan University in 1846, became teacher of mathematics in Wilbraham Academy, Massachusetts, and later professor of geology, etc., in that institution. In 1862 he was appointed professor of geology in Northwestern University, Evanston, Illinois, but taught in addition, at times, other branches of science and even some branches in other lines. He was twice acting president of the university. In conjunction with Prof. Alexander Winchell, he prepared a monograph on Fossils from the Niagara Limestone of Chicago, which was read to the Boston Society of Natural History. In 1866 he was naturalist to a Government expedition to the Bitter Root Mountains in Idaho and Montana, in which he collected scientific material, and of which he published an account in 1867. He wrote papers concerning the geology of the shore of Lake Michigan and of the region about Chicago; brought two fossil trees found in the university grounds to scientific notice; and contributed considerably to geological publications. He was curator to the natural history collection of his university for nearly thirty years. Two fossil species and a mountain in Montana have been named after him.

Which is the Fittest to Survive?—Prof. A. W. Rücker spoke in his opening address at the recent meeting of the International Magnetic Conference in Bristol, England, of what seems to be a law of Nature, that the products of an organism are fatal to itself; in accordance with which, he said, pure science is threatened by the very success of its practical applications. The smoke of our cities blots the stars from the vision of the astronomer, and now the science of terrestrial magnetism is threatened by the artificial earth currents of the electric railway. Prof. W. E. Ayrton, in his welcoming address, took another view of the subject and answered the reference the electrical engineers make to the principle of the survival of the fittest when they are told of the ruin their wires are bringing upon magnetic observatories—"So much the worse for the observatories"—"Can the system of electric traction that has already destroyed the two most important magnetic observatories in the United States and British North America be the best and fittest to survive? Again, do we take such care and spend such vast sums in tending the weak and nursing the sick because we are convinced that they are the fittest to survive? May it not be perhaps because we have an inherent doubt about the justice of the survival of the strongest, or perhaps because even the strongest of us feels compelled modestly to confess his inability to pick out the fittest, that modern civilization encourages, *not* the destruction but the preservation of what has obvious weakness, on the chance that it may have unseen strength? When the electrical engineer feels himself full of pride at the greatness, the importance, and the power of his industry, and when he is inclined to think slightingly of the deflection of a little magnet compared with the whirl of his one-thousand-horse-power dynamo, let him go and visit a certain dark storeroom near the entrance hall of the Royal Institution, and while he looks at some little coils there, ponder on the blaze of light that has been shed over the whole world from the dimly lighted cupboard in which these coils now lie. Then he may realize that while the earth as a magnet has endured for all time, the earth as a tramway conductor may at no distant date be relegated to the class of temporary makeshifts, and that the raids of the feudal baron into the agricultural fields of his neighbors were not more barbarous than the alarms and excursions of the tramway engineer into the magnetic fields of his friends."

Teaching the Teachers.—The following suggestive paragraph is taken from the inaugural address of William Henry Preece, president of the British Institution of Civil Engineers: "Our educational methods have begun at the wrong end. We ought to teach the masters first and then the men. Moreover, we have to teach the teachers and those who have control of the purse-strings. The County Councils of England are scarcely qualified as yet to discharge the very serious duty of properly dealing with a question so few of them understand—though many of them have tackled the matter manfully, especially the London County Council, through its Technical Education Board, on which a large proportion of co-opted experts have seats, who, by supporting existing institutions, have contributed toward the supply of teachers. But how are we to approach the masters? A fault once discovered is halfway to repair. It is difficult to remove the scales from the eyes of the man who has been successful in business and knows not of his blindness; but the coming generation will be more enlightened, and the future masters better educated. We are suffering from a lack of competent teachers. A teacher who has had no training in the practical world is worse than useless, for he imparts ideas derived from his inner consciousness or from the false teaching of his own abstract professor, which lead to mischief. In my own experience I have met with very serious inconveniences from this cause. The ideal professor of pure abstract science is a very charming personage, but he is a very arrogant and dogmatic individual, and, being a sort of little monarch in his own laboratory and lecture room, surrounded by devoted subjects, his word is law, and he regards the world at large, especially the practical world, as outside his domain and beneath his notice. He is generally behind the age. These are not the men for technical institutes. Such teachers should possess the diploma of this institution."

The People of India and the Missionaries. — In the light of three months' special observation, J. T. Sunderland has reviewed in the New World Magazine the prospects of the success of Christian missions in India. There are several causes that hinder their progress, among which the author mentions as more important the number of Christian sects and denominations; the character of the doctrines preached, in that in many aspects they do not appeal to Hindu or Mohammedan faith or modes of thought, and in some contradict them, and as to those points are a serious hindrance to the progress of Christianity; and the vices of many Europeans, creating a prejudice against their professed religion that is not wholly contradicted by the testimonies and examples of the missionaries and men of nobler stamp. To the last objection the answer is easy, though it may not always be convincing, that these wicked men sin not because they are natural products of Christianity, but because they disobey it. A strong factor in disarming prejudice against Christianity and winning favor for it is the fact that through it, directly or indirectly, certain very important kinds of good are coming to India—education, schools, books, science, invention. The contact of India with Christian lands, civilization, thought, and life, is steadily telling upon Indian thought. Further, "it is to be said to the honor of all the Protestant missions of India, at least, of whatever name, that they are helping, instructing, and lifting up the lower classes, and offering them hopes and prospects such as they could not have had under their old faiths. This is much, very much." The very presence of the missionary in a community is likely to be an enlightening influence. He is a man of more than common education, and "has brought with him to India something of the thought, the culture, the ideals of life, the habits and customs of the Western world. He introduces higher standards of living. He gives his influence in favor of better public sanitation, better homes for the people, better streets and public buildings, better public improvements generally. His home and family life, in which the wife receives the same consideration as her husband, and the daughters are educated with the same care as the sons, becomes a valuable object lesson in the community where he dwells." The missions as a whole are regarded by the author as an important factor in a great religious evolution. The precise form and direction which this evolution will take seem to be a matter yet to be determined.

Weeds under Cultivation.—For several years past the botanical department of Michigan Agricultural College has maintained a "weed garden," and has grown a hundred or more species of the most troublesome weeds in plots. Some curious results from the experiments are recorded by Prof. W. J. Beal in a paper read at the meeting, 1897, of the Society for the Promotion of Agricultural Science. The most vigorous and aggressive weeds seem to take on under cultivation the weakness and capriciousness of delicate cultivated plants. "It is very instructive," Professor Beal says, "to note how much better many of these plants thrive when they get away from the spot where they have been confined for from two to several years. Seedlings of Jamestown weed were larger in the plantain bed than in their own. After three years the plantain nearly ran out and *Amaranthus albus* entirely disappeared. One species of pigweed grew finely for two years, but afterward made a small display; and another variety did not seem very persistent for a plant that ranked among the weeds, but shied off from its home ground 'as if searching for fresh fields.' Barnyard grass (*Panicum crus-galli*) behaved like pigweed, and 'needed considerable attention.' The little round-leaved mallow, which roots deeply about rubbish piles in mellow soil, was grown of respectable proportions in the garden with considerable difficulty, and with no more ease in the bottom lands of other parts of the botanic garden. Considerable pains is required every year to keep on hand even fairly well-grown specimens of mullein. Knotgrass, which thrives with abuse and seems to enjoy trampling by feet, was grown with difficulty in the plots. 'Insects prey upon it; rust causes it to dwindle and disappear.' 'Motherwort grows rank four feet high near the barnyard fence, and the flowers are covered with bees, but when kept several years in the same bed it goes off into the sulks as though neglected.' Shepherd's purse is often disturbed by a parasitic fungus, and it is difficult to grow nice plants long in the same place. Cocklebur, if found long in the same spot, is troubled sadly with a mildew, and more recently also with a rust."

Operations against Woodchucks.—Prof. F. H. Storer records in the Bulletin of the Bussey Institution, Harvard University, the results of his experiments in the destruction of woodchucks, which, besides being very injurious to lands he had under cultivation, appeared to be increasing. Smothering by a volatile liquid driven into the burrow has been suggested by Professor Hilgard, who recommends bisulphide of carbon. Professor Bussey finds that liquid not wholly satisfactory and liable to objections, and prefers a preparation of naphtha or other volatile liquid. In any event, some device seems to be needed for forcing a considerable quantity of the vapor into the very end of the burrow. Poisons are dangerous because of the probability that the animal would bring the food on which they are placed to the mouth of the burrow for eating, where children or useful animals might get it. While experimenting with burning Cayenne pepper or sulphur on touch paper, in order to smoke out the burrows, the author became acquainted with the "woodchuck torches" of Mr. B. M. Wedger, of Roslindale, Massachusetts. These consist of nitrate of soda, sulphur, mealed gunpowder, and sulphide of antimony, so packed into a tube like a Roman candle that on burning the fuse the vapors would be forced by great pressure to the farthest recesses of the burrow. They proved effectual, and it was indeed rare that any woodchuck to which they were applied ever reported himself again. Professor Storer also describes some experiments he made in burning sulphur in the burrows, with special expedients for insuring more rapid and perfect combustion of the sulphur; these promised fairly well. Mr. Henry Stewart has described in the Country Gentleman an effectual method of destroying woodchucks with blasting powder or dynamite.

Evolution in Lamps.—The story of lamps from Herodotus down to 1830, Mr. Henry C. Mercer says, in an instructive study on Light and Light Making in the contributions of the Bucks County (Pa.) Historical Society, is not one of development. In principle and form they remain the same, whether as the tin cylindrical or boat-shaped cups on candlestick pedestals and the round tin cups with hemispherical lids, or the lidless cups resting on wooden stands such as were recently rescued by the author from the garret rubbish of old Bucks County. And before Herodotus, as we follow the lamp back into the tombs of the Old World, we find the boat-shaped form of earthenware preceding the boat-shaped form of iron and possibly even that of bronze. The chalk-cup lamp found by Canon Greenwell in the neolithic flint mines at Grimes Graves, England, perhaps the oldest wick-floating lamp in the world, is not essentially different from the oyster shell filled with lard and provided with wicks that may be found among Virginia negroes to-day. The Egyptian, Grecian, Phœnician, and Roman lamps, as they have been found in the tombs and as we see them in the museums, are not unlike the lard lamps that were most in use early in the nineteenth century. Then crude grease gave way to sperm oil and lard oil, with especial adaptations of the lamps that made them more convenient and improved the light; and burning fluids that were convenient and clean and gave a brilliant light, but were dangerous; and kerosene, with other improvements in the lamps and refinements in the oil that enabled it to give the most perfect artificial light yet found and to keep up the fight for quality with gas and electricity—all these having come in within the lifetime of men still among us. Besides the old lamps, our ancestors had candles, molded when the price of tin, the material for the molds, did not forbid the luxury, and before them tallow dips; a suspended wick was dipped into a pot of hot tallow, on a cold day, and the operation was repeated till layer after layer of grease hardened, and the candle was thick enough. These candles were, however, troublesome in hot weather, on account of their propensity to yield to the temperature and fall over. "Who shall say, however, that candle-dipping is older than molding, when we know . . . that they molded candles in County Galway, Ireland, in late years by punching holes in peat and pouring in tallow on the down-hung wick of twisted flax fiber?" The Irish had, too, as had the negroes, the rush light, a greased rush set in a hole in a wooden block serving as a candlestick; or rushes joined in a triple twist which flies apart when lighted, increasing the blaze. From this Mr. Mercer passes to forms of candlesticks and torches and cressets and methods of producing fire, whither we can not follow him, for the multitude of details he notices, which will not bear abstracting.

Inconsistent Philozoists.—In his address at the opening of the physiological and pathological laboratories at Belfast, Ireland, Lord Lister took occasion to give some illustrations, drawn from practice, of the value of pathological research. "There are people," he said, "who do not object to eating a mutton chop—people who do not even object to shooting a pheasant with a considerable chance that it may be only wounded and may have to die after lingering in pain, unable to obtain its proper nutriment—and yet who consider it something monstrous to introduce under the skin of a guinea-pig a little inoculation of some microbe to ascertain its action. These seem to me to be most inconsistent views. If these experiments upon the lower animals were made for the mere sport of the thing, they would be indeed to be deprecated and decried; but if they are made with the wholly noble object of not only increasing human knowledge, but also of diminishing human suffering, then I hold that such investigations are deserving of all praise. Those little know who lightly speak on these matters how much self-denial is required in the prosecution of such researches when they are conducted, as indeed they always are, as far as I am aware, with the object of establishing new truth."

The Ruins of Xkichmook, Yucatan.—The group of ruins in Yucatan called Xkichmook was discovered by Mr. Edward H. Thompson in 1888, when he read a paper before the American Antiquarian Society embodying his first impressions of it. He has since made studies of it extending over a period of seven years. The group is about one hundred and forty miles south of Merida and forty or fifty miles east of Campeche, situated in a narrow valley between a series of rocky hills, and has to be approached by precipitous paths over the hillsides, and thence down the beds of dry *arroyos* whose yearly freshets wash away all vegetation. Ten buildings, including one called the Palace, and two mounds were explored, and some miscellaneous excavations were made—all of which are described in the author's paper (Field Columbian Museum), with figures of the buildings and objects. Pottery and flaked stone implements were plentiful, but polished implements and specimens of sculpture were exceedingly rare. The flat under surfaces of the ceiling stones of the vaulted chambers seem to have contained very elaborate designs; in another chamber portions of a painting were still partly preserved; in another, curious drawings or glyphs in strong black lines once existed; in another was a painted human figure, of which only the flowing headdress, a portion of the face, and certain devices issuing from the mouth and probably indicating speech, now remain. The mysterious red hand was found painted in various places, and in one a human hand in blue pigment was found, the impression of which was so fresh and perfect in places that even the minute lines of the skin were visible. In ten years of investigation among the ruins of Yucatan and Campeche not as many specimens of worked obsidian were found as could be picked up in half an hour among certain Mexican ruins; but traces of ancient fabrication of flint implements were more plentiful than anywhere else.

The Seventeen-Year and the Thirteen-Year Locusts.—The periodical cicada, or seventeen-year locust, as it is called, is distinctly American, and has the longest life period of any known insect. It is especially remarkable, Mr. C. L. Marlatt observes in his memoir upon it, in its adolescent period, the features of particular divergence from other insects being its long subterranean life of thirteen or seventeen years, and the perfect regularity with which at the end of these periods every generation, though numbering millions of individuals, attains maturity almost at the same moment. At this moment the brood issue from the ground, leaving innumerable exit holes, and swarm over trees and shrubs, filling the air with their strident calls, and laying their eggs in slits which they cut in the trees. The larvæ, when hatched, fall to the ground, and quickly burrow out of sight, each "forming for itself a little subterranean chamber over some rootlet, where it remains through winter and summer, buried from sun, light, and air, and protected in a manner from cold and frost. . . . It lives thus alone in its moist earthen chamber," rarely changing its position unless some accident to the nourishing rootlet may necessitate its seeking another, passing the thirteen or seventeen years of its hypogeal existence in slow growth and preparation for a few weeks only of winged life in the air and light. Other cicadas appear every year, usually in comparatively small numbers. They are probably equally long in maturing, but the periods of their lives have from some cause or another been cast in "off" years. The thirteen-year broods are southern, and the shortening of their periods of development may possibly be accounted for by the longer season of warmth in the southern year giving them the number of hours or of aggregate degrees of warmth in thirteen years that the more northern broods can not receive in less than seventeen years. This, however, is only speculation, and there are difficulties in applying the supposition to make it fit all the facts; and many believe that the two races are specifically different. The late Prof. Charles V. Riley distinguished twenty-two different broods of cicadas in the United States, seven of which appertain to the thirteen-year period (*Cicada tredecem*).

MINOR PARAGRAPHS.

The Bureau of Nature Study of Cornell University is making a praiseworthy effort to interest children in caring for birds, or, as its circular has it, treating them as "summer boarders." It publishes a leaflet entitled The Birds and I, which it sends free to teachers who ask for it and who will give it to their pupils. It has pictures of various styles of bird houses, which may serve as patterns for the construction of homes for the summer guests. "The kind of birds," the interesting circular of the bureau says, "that will set up housekeeping in the homes that you provide will harm no one. They are never cross, never throw stones or rob us, but are always happy and have cheerful songs. We are always kind to people having such dispositions, and why should we not be so to birds as well?" The bureau invites correspondence from boys and girls disposed to entertain birds.

The National Geographic Society offers prizes of one hundred and fifty dollars and seventy-five dollars severally for the first and second best essays relating to pre-Columbian discoveries and settlements of the Norsemen on the mainland of North America, and the location of the lands mentioned in the Icelandic Sagas, the competition to close December 31, 1899. The essays sent in should be typewritten in the English language, not exceeding six thousand words in length, and may be accompanied by maps and illustrations for explanation of the text, but not for embellishment. The committee of awards consists of Mr. Henry Gannett, Prof. Albert Bushnell Hart, Mrs. Anita Newcomb McGee, Prof. John Bach McMaster, and Coast Survey Superintendent Henry S. Pritchet.

Experiments by a German naturalist, Herr Albrecht Bethe, summarized in the *Revue Scientifique*, upon recognition of one another by ants, confirm the opinions of Lubbock, McCook, Forel, and others that they are guided by the sense of smell. Herr Bethe found that an ant "whitewashed" with liquid of ants of its own nest was well received by its fellows when it went among them; but when the liquid of ants of a different nest was applied it was attacked at once. An ant washed with alcohol, next with water, and then with the liquid of a strange species was well received in a nest of that species, although it was much smaller than any of the individuals composing it. Another ant washed with alcohol and water, dried, and immediately returned to its fellows of its own nest, was attacked by them; but when kept for twenty-four hours after drying, or long enough to recruit itself, was received by them.

The following tables are taken from a paper by Dr. J. Richardson Armstrong in a recent Lancet, describing his experience with diphtheria antitoxine in private practice in treating one hundred and twenty-two cases of diphtheria:

		Recovered.	Died.
1.			
Total number of cases treated from June 27 to Dec. 17, 1897	42	36	6
Severe cases; antitoxine injected......	22	20	2
Mild cases; antitoxine not injected...	20	16	4
2.			
Total number of cases treated, January 1 to December 31, 1898............	80	77	3
Severe cases, injected	55	54	1
Mild cases, non-injected	25	23	2

In answer to the question, Should every case of diphtheria be treated with antitoxine, Dr. Armstrong says: "Some of the cases are sufficiently mild not to need it, so I will not go so far as to say that it is absolutly essential to inject in every case, although I would call it an excellent practice to do so, and the patients would make much more rapid recoveries. I think that injection ought to be insisted upon as early as possible in every case that is at all severe or likely to prove so, and I think that the medical man who does not employ antitoxine and who loses a large proportion of his cases is incurring a responsibility which is almost criminal. The earlier a patient is injected the greater is the chance of recovery, and the more rapid is the recovery."

Among the leading principles of forestry, as defined by the chief fire warden of Minnesota, are that the best agricultural land should not be devoted to forest while wood and timber can be profitably grown on soil that is unfit for farming purposes; that the management should be continuous, and no more timber should be taken out of the forest in one year, or in a series of ten or twenty years, than grows in the entire forest in the same period; that the cutting of timber should be in blocks or strips, so as to facilitate reproduction on the clear areas by seeds falling from the trees left standing; and that the forest, when young, must have in numbers vastly more trees than when it is mature. To make good timber, the forest, when young, must be crowded so as to secure height growth. Mixed wood, managed on forestry principles in the Black Forest of Germany, has per acre, at the age of twenty years, 3,960 trees; at the age of one hundred years, 262 trees.

A new process for the production of a textile material is thus described in Industries and Iron: "It consists of 'squirting,' in a fashion similar to that of making electric incandescent carbons, pure gelatin in threads of about one thousandth part of an inch in diameter, the thread being taken away on revolving tapes. The threads are wound upon reels and exposed to formalin vapor, which exercises a most remarkable effect on the gelatin, rendering it insoluble in any medium yet applied to it. The tensile qualities of the thread are also increased, while, in opposition to that produced under the Lehner process (which is simply forming nitrated cellulose into threads for weaving), it is capable of taking up any dye desired; and it is, of course, impervious to any hygroscopic influence.

NOTES.

Prof. E. C. Pickering, of the Harvard College Observatory, announces the discovery by Mrs. Fleming of a new variable star in Sagittarius. It was found on eight of the photographs in her large collection. On March 8, 1898, it was of the fifth magnitude, and on April 29, 1898, of the eighth magnitude. A plate taken on March 9, 1899, shows it still visible and of the tenth magnitude. Its spectrum resembles that of other new stars. The entire number of new stars discovered since 1885 is six, of which five have been found by Mrs. Fleming.

Because of the great loss by fire which occurs every year in the Russian villages, the government is making efforts to induce the peasantry, says the *Saturday Review*, to employ some less dangerous material than straw thatch for the roofing of their *izbas*. There has already been a large increase in the use of shingle, and this has led to a considerable importation from Belgium and Germany, and also from the United States, of simple and inexpensive shingle-making machines, for use in rural districts. German manufacturers, whose "commercial intelligence department" is remarkably well informed, are now making redoubled efforts to meet the immense demand anticipated. An improved and inexpensive hand fire engine is also being provided. Roofing felt or paper is very generally used under the shingle, and the demand for this is also increasiug.

A fourth specimen of the *Notornis Mantelli*, a bird of New Zealand supposed to have become extinct, was captured in August last, and has been prepared for the museum by Mr. W. B. Benham. The first specimen was obtained, recently slain, by Mr. W. Mantell, in 1849, and is preserved in the British Museum; the second was killed by Maoris in 1851, and is in the Colonial Collection; and the third, now in the Dresden Museum, was taken in 1879. All these birds were found in a single denuded region of the country. The present specimen was caught by a dog in the bushes near Lake Te Anan, still in the same region, and is a very fine young female.

A plant growing in the dense jungles of Langsuam, Siam, was described by H. Warington Smyth, in an address to the Royal Geographical Society, as having the property of setting up a great irritation in the skin of any person coming in contact with it. "It has a large, broad leaf, and the Siamese declare that, after being badly stung by it, the only remedy is the heat of a fire; to bathe in a stream, which is the natural impulse, is considered absolutely fatal. A spot on the

Kra-Champawn trail is known as *Burma-tai*, from the fact that a party of Burmese, coming across to harry their neighbors in the old fighting days, are said to have got into a thick growth of this plant, and to have bathed in the stream to allay the agony, with the result that they all died there." The Siamese call the plant *kalang-ton chang*.

In the western part of Belgium the dog has been employed as a beast of burden from time immemorial. The Belgian dog (known only by this name) is a large, compactly built animal, measuring from twenty to thirty inches in height; the hair is smooth and short, generally tan or dark brown in color. It is the custom to crop both ears and tail. The dogs are usually driven before carts weighing from one hundred to one hundred and twenty pounds, in teams of from two to six abreast. A harness very similar in arrangement to that of the horse is used. Six of these animals will draw from six to eight hundred pounds. They are put to work when about a year old. They vary in price from twenty-five to sixty shillings. There are over two thousand dogs in Ghent licensed as draught animals.

A plant described by M. Henri Chantrey as most probably answering to the manna found by the Hebrews in the desert is the thallophyte *Canona esculenta*, or edible lichen, which grows in the deserts of Persia, Arabia, Mesopotamia, and Sahara. It is a grayish cryptogam of about the size of a pea, bearing short bracteate appendages on its top; when cut, it resembles a mass of dull white flour paste. It is an ephemeral substance, and must be collected the morning it appears, as it will soon dry up; but when properly prepared it can be kept in a close vessel. It is highly appreciated by the wandering Arabs, who have often been saved by it from starvation, and they lay up stores of it when opportunity offers. It is easily collected, for it never adheres to any foreign body, and, so far as appearance goes, seems as if it might have been thrown on the ground. There is but little suggestion of the mushroom in its taste, which is rather starchy, with a slight flavor of sugar. Cattle are very fond of it. The Arabs boil it into a gelatinous paste, which they serve in various ways. They preserve it by drying it in the shade and pack it in bladders or skins. It is not a complete first-class food, but is very good for a few days till something better can be got.

The Jernkontoret of Sweden is an iron-masters' exchange at Stockholm, which was founded in 1747 for the financial convenience of the subscribers, and now possesses a reserve fund of about $1,500,000. The functions of the society have been considerably enlarged since its institution. It has organized a corps of mining engineers and metallurgists, who receive salaries from it, and further from manufacturers whom they may serve. They are often commissioned to go abroad and obtain information and practical hints bearing upon their profession. The institution is supported by a light assessment on the production of its constituency. It has a fine building, and publishes an annual volume in *Jernkontorets Annalen*, containing original memoirs and reports from technical agents, which is sent gratuitously to all the masters of forges in Sweden, and is sold abroad.

In a number of glass mirrors of the third and fourth centuries, examined by M. Berthelot, the glass was coated with a metallic substance and with a layer of whitish material. The metal proved to be lead, with no trace of gold, silver, copper, tin, antimony, or mercury, and no sign of organic substance was present. It was thus shown that no extraneous material was used to cement the lead to the glass. The mirrors appeared to have been cut from hollow blown glass globes, and it is possible that before the globe was cut the molten lead had been poured into the interior, and had adhered to the previously warmed glass. The whitish layer consisted of lead carbonate and lead oxide formed by the oxidation of the lead coating and calcium carbonate, which had been deposited from the water of the district in which the mirrors were found.

The list of recent deaths among men known in connection with science and its applications includes the names of Prof. Karl Müller, botanist, one of the founders of the German scientific weekly, *Die Natur*, February 9th, aged eighty-one years; Sir John Struthers, emeritus professor of anatomy in the University of Aberdeen, in his sixty-seventh year; John Kreusi, mechanical engineer and inventor, at Schenectady, N. Y., January 22d, aged fifty-six years; Thomas Cook, teacher of anatomy and author of works on the subject, in London, February 8th; Dr. A. Veitmeyer, civil engineer, in Berlin; Dr. Carl Schoenlein, of the Zoölogical Station at Naples, aged forty years; Major-General Joseph J. Reynolds, of the United States Army, formerly professor of mechanics and engineering at Washington University, St. Louis, February 26th, aged seventy-seven years; Dr. Alexandre Laboulbène, professor of the history of medicine in the University of Paris, and author of a treatise on pathological anatomy and a book on French entomological fauna, aged seventy-three years; Dr. Philipp J. J. Valentini, Americanist and student of ancient Mexican and Central American monuments and codices, in New York, March 16th, in his seventy-first year; Gustave Wiedmann, professor of physics and chemistry in the University of Leipsic, and writer on electricity and magnetism; and Major J. Evans, professor of pathology in the Calcutta Medical College, March 13th.

THOMAS EGLESTON.

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NEW METHOD OF ESTIMATING THE AGE OF NIAGARA FALLS.

By G. FREDERICK WRIGHT.

BOTH the interest and the importance of the subject make it worth while to follow out every clew that may lead to the approximate determination of the age of Niagara Falls. During this past season, in connection with some work done for the New York Central Railroad upon their branch line which runs along the eastern face of the gorge from Bloody Run to Lewiston, I fortunately came into possession of data from which an estimate of the age of the falls can be made entirely independent of those which have heretofore been current. The bearing and importance of the new data can best be seen after a brief *résumé* of the efforts heretofore made to solve this important problem.

In 1841 Sir Charles Lyell and the late Prof. James Hall visited the falls together; but, having no means of determining the rate of recession, except from the indefinite reports of residents and guides, they could place no great confidence in the "guess," made by Sir Charles Lyell, that it could not be more than one foot a year. As the length of the gorge from Lewiston up is about seven miles, the time required for its erosion at this rate would be thirty-five thousand years. The great authority and popularity of Lyell led the general public to put more confidence in this estimate than the distinguished authors themselves did. Mr. Bakewell, another eminent English geologist, at about the same time estimated the rate of the recession as threefold greater than Lyell and Hall had done, which would reduce the time to about eleven thousand years.

But, to prepare the way for a more definite settlement of the question, the New York Geological Survey, under Professor Hall's direction, had a careful trigonometric survey of the Horseshoe Fall made in 1842, erecting monuments at the points at which their angles

Fig. 1.—Looking north from below the Whirlpool, showing the electric road at the bottom of the east side of the gorge, and the steam road descending the face about halfway to the top.

were taken, so that, after a sufficient lapse of time, the actual rate of recession could be more accurately determined. In 1886 Mr. Woodward, of the United States Geological Survey, made a new survey, and found that the actual amount of recession in the center of the Horseshoe Fall had proceeded at an average rate of about five feet per annum. The subject was thoroughly discussed by Drs. Pohlman and Gilbert, at the Buffalo meeting of the American Association in 1886, when it was proved, to the satisfaction of every one, that, if the supply of water had been constant throughout its history, the whole work of eroding the gorge from Lewiston to the Falls would have been accomplished, at the present rate of recession, in about seven thousand years.

But the question was immediately raised, Has the supply of water in Niagara River been constant? It was my privilege, in the autumn of 1892 (see Bulletin of the Geological Society of America, vol. iv, pp. 421–427), to bring forth the first positive evidence that the water pouring over Niagara had for a time been diverted, having been turned through Lake Nipissing down the valley of the Mattawa into the Ottawa River, following nearly the line of Champlain's old trail and of the present Canadian Pacific Railroad. The correctness of this inference has been abundantly confirmed by subsequent investigations of Mr. F. B. Taylor and Dr. Robert Bell.* The occasion of this diversion of the drainage of the Great Lakes from the Niagara through the Ottawa Valley was the well-known northerly subsidence of the land in Canada at the close of the Glacial period. When the ice melted off from the lower part of the Ottawa Valley the land stood five hundred feet lower than it does now, but the extent of this subsidence diminished both to the south and the west, making it difficult to estimate just how great it was at the Nipissing outlet. A subsidence of one hundred feet at that point, however, would now divert the waters into the Ottawa River. That it actually was so

FIG. 2.—View looking east across the gorge near the mouth, showing the railroads and the outcrops of Clinton and Niagara limestones above the steam road.

diverted is shown both by converging high-level shore lines at the head of the Mattawa Valley and by the immense delta deposits at its junction with the Ottawa, to which attention was first called in my paper referred to above.

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* See article by Mr. Taylor on The Scoured Bowlders of the Mattawa Valley, in the American Journal of Science, March, 1897, pp. 208–218.

The indeterminate question which remained was, At what rate did this postglacial elevation of land which has brought it up to its present level proceed? Dr. Gilbert, Professor Spencer, and Mr. Taylor have brought forth a variety of facts which, according to their interpretation, show that this rate of elevation was so slow that from twenty thousand to thirty thousand years was required to restore to the Niagara River its present volume of water. Their arguments are based upon the varying width and depth of the Niagara gorge, proving, as they think, the presence of a smaller amount of water during the erosion of some portions. Dr. Gilbert has also brought forward some facts concerning the extent of supposed erosion produced by the diverted waters of Niagara when passing over an intermediate outlet between Lake Simcoe and Lake Nipissing. But the difficulty of obtaining any safe basis for calculation upon these speculative considerations has increased the desire to find a means of calculation which should be independent of the indeterminate problems involved. That I think I have found, and so have made a beginning in obtaining desired results. *The new evidence lies in the extent of the enlargement of the mouth of the Niagara gorge at Lewiston since the recession of the falls began.*

It is evident that the oldest part of the Niagara gorge is at its mouth, at Lewiston, where the escarpment suddenly breaks down to the level of Lake Ontario. The walls of the gorge rise here to a height of three hundred and forty feet above the level of the river. It is clear that from the moment the recession of the falls began at Lewiston the walls of the gorge on either side have been subject to the action of constant disintegrating agencies, tending to enlarge the mouth and make it V-shaped. What I did last summer was to measure the exact amount of this enlargement, and to obtain an approximate estimate of the rate at which it is going on.* As this enlargement proceeds wholly through the action of atmospheric agencies, the conditions are constant, and it is hoped that sufficiently definite results have been obtained to set some limits to the speculations which have been made upon more indefinite grounds.

The face on the east side of the gorge presents a series of alternate layers of hard and soft rocks, of which certain portions are very susceptible to the disintegrating agencies of the atmosphere. The summit consists of from twenty to thirty feet of compact Niagara limestone, which is underlaid by about seventy feet of Niagara shale; which in turn rests upon a compact stratum of Clinton limestone

* For opportunity to do this work I am indebted to the interest of President S. R. Callaway, of the New York Central Railroad. The measurements were made by Mr. George S. Tibbits, engineer of the western division. The photographs were taken by Mr. C. F. Dutton, of Cleveland.

about twenty feet thick, which again is underlaid by a shaly deposit of seventy feet, resting upon a compact stratum of Medina sandstone twenty feet thick, below which a softer sandstone, that crumbles somewhat readily, extends to the level of the river.

The present width of the river at the mouth of the gorge is seven hundred and seventy feet. It is scarcely possible that the original width of the gorge was here any less than this, for in the narrowest places above, even where the Niagara limestone is much thicker than at Lewiston, it is nowhere much less than six hundred feet in width. Nor is it probable that the river has to any considerable extent enlarged its channel at the mouth of the gorge at the

Fig. 3.—Looking up the gorge from near Lewiston, showing on the left the exposed situation of the eastern face of the gorge at the extreme angle, where the measurements were made.

water level. On the contrary, it is more probable that the mouth has been somewhat contracted, for the large masses of Niagara and Clinton limestone and Medina sandstone which have fallen down as the shales were undermined have accumulated at the base as a talus, which the present current of the river is too feeble to remove. This talus of great blocks of hard stone has effectually riprapped the banks, and really encroached to some extent upon the original channel.

We may therefore assume with confidence that the enlargement, under subaërial agencies, of the mouth of the gorge at the top of the escarpment has been no greater than the distance from the present water's edge to the present line of the escarpment at the summit of the Niagara limestone. This we found to be three hundred and eighty-eight feet—that is, the upper stratum of hard rock on the east side of the gorge had retreated that distance, through the action of atmospheric agencies, since the formation of the gorge first began. The accompanying photogravures and diagram will present the facts at a glance. The total work of enlargement on the east side of the gorge has been the removal of an inverted triangular section of the rock strata three hundred and forty feet high and three hundred and eighty-eight feet base, which would be the same as a rectangular section of one hundred and ninety-four feet base. From this one can readily see that if the average erosion has been at the rate of one quarter of an inch per annum, the whole amount would have fallen down in less than ten thousand years; while if the time is lengthened, as some would have it, to forty thousand years, the rate would be reduced to one sixteenth of an inch per year.

Fortunately, the construction of the railroad along the face of the eastern wall of the gorge affords opportunity to study the rate of erosion during a definite period of time. The accompanying photogravures will illustrate to the eye facts which it is hard to make impressive by words alone. The course of the road is diagonally down the face of the gorge from its summit for a distance of about two miles, descending in that space about two hundred feet to the outcrop of hard quartzose Medina sandstone. The lower mile of this exposure presents the typical situation for making an estimate of the rate at which the face is crumbling away.

Beginning at what used to be known as the "Hermit's Cave," near the Catholic College grounds, where the Niagara shale is well exposed, and extending to the outer limit of the gorge, the height of the face above the railroad averages one hundred and fifty feet. Now, the crumbling away of the superincumbent cliffs gives continual trouble to the road. Three watchmen are constantly employed along this distance to remove the *débris* which falls down, and to give warning if more comes down than they can remove before trains are due. The seventy feet of Niagara shale, and the equal thickness of shaly Medina rock which underlies the Clinton limestone, are constantly falling off, even in fair weather, as any one can experience by walking along the bank; while after storms, and especially in the spring, when the frost is coming out, the disintegration proceeds at a much more rapid rate. Sometimes two or three days are required by the whole force of section hands to throw over the bank the result of a single fall of material.

At a rate of one quarter of an inch of waste each year the amount of *débris* accumulating for removal on the track along this distance would be only six hundred and ten cubic yards per annum—that is, if six hundred and ten cubic yards of material falls down from one mile of the face of the wall where it is a hundred and fifty feet high, the whole amount of enlargement of the mouth of the gorge would be accomplished in less than ten thousand years. Exact accounts have not been kept by the railroad; but even a hasty examination of the face of the wall makes it sure that the actual amount removed has been greatly in excess of six hundred yards annually. This estimate is based partly on the impression of the railroad officials as to the cost of removal, and partly on the impressions of the watchmen who spend their time in keeping guard and in the work of removing it.

FIG. 4.—Nearer view of the upper portion of the face near the mouth, showing the exposure of the situation at that point.

But that is not all. The accompanying photogravures indicate an actual amount of removal over a part of the area enormously in excess of the rate supposed. Fig. 5 shows a portion of the precipice, a hundred feet high, where the road first comes down to the level of the Clinton limestone, and where, consequently, the whole thickness of the Niagara shale is accessible to examination. Fortunately, Patrick MacNamara, the watchman at this station, was a workman on the road at the time of its construction in 1854, and has been connected with the road ever since, having been at his present post for twelve years. We have therefore his distinct remembrance, as well as the appearance of the bank, to inform us where the face of the original excavation then was. In the picture he is standing at the original face, while the other figure is nearly at the back of the space which has been left empty by the crumbling away of the shale. The horizontal distance is fully twenty feet, and the rocks overhang to that amount for the whole distance exposed in the photograph. All this amount of shale has fallen down in forty-four years, making a rate many times larger than the highest we have taken as the basis of our estimate. Of course, this rate for the crumbling away of the Niagara shale on its fresh exposure is much in excess of the average rate for a long period of time; but it is clear that the rate of erosion at the base of the Niagara limestone at the mouth of the gorge can never

Fig. 5.—Showing extent of erosion at base of the Niagara shale since 1854. (See description in the text.)

have been sufficiently slow to reduce the total average much below the assumed rate of a quarter of an inch a year.

To impress the truth of this statement it is only necessary to follow the progress, in imagination, of the crumbling process which has brought the side of the gorge to its present condition. At first the face of the gorge was perpendicular, the plunging water making the gorge as wide at the bottom as at the top. At successive stages the strata of shale on the side would crumble away, as is shown in our photograph, and undermine the strata of hard rock. The large fragments would fall to the bottom, and, being too large to be carried away by the current, would form the talus to which we have already referred, which would grow in height with every successive century. The actual progress of the enlargement would thus be periodic, and not capable of measurement by decades; but after centuries the progress would be clearly marked, and especially whenever there was a falling away of the lower stratum of compact Medina sandstone, which is about two hundred feet below the top, would a new cycle of rapid disintegrations in the superincumbent strata follow.

An important point to be noticed, and which is evident from two of the reproduced photographs (Figs. 3 and 4), is that the talus has never reached up so high as to check the disintegration at the mouth of the gorge of the Niagara shale and limestone which form the upper one hundred feet of the face, and which exhibit the maximum amount of enlargement which has taken place. The thickness of the Niagara limestone is here so small that it has not been so important an element in forming the talus as it has been farther up the stream, where it is two or three times as thick. Now, while our original supposition was that one quarter of an inch annually was eroded from the upper two hundred feet, this would involve the erosion of a half inch per annum over the top of the gorge to bring the calculation within the limit of ten thousand years. It certainly is difficult for one who examines the facts upon the ground to believe

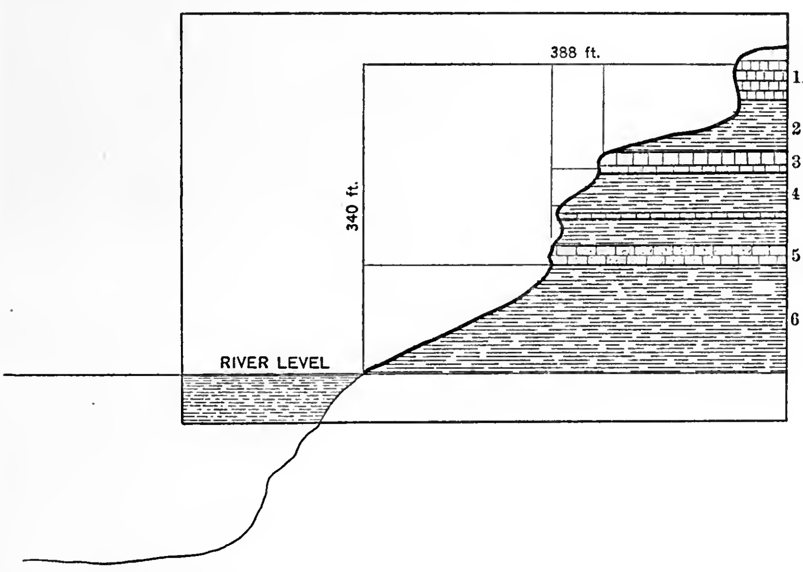

Fig. 6.—Section, drawn to equal vertical and horizontal scale, showing enlargement of Niagara gorge on the east side at its mouth at Lewiston: 1, Niagara limestone, 20 to 30 feet; 2, Niagara shale, 70 feet; 3, Clinton limestone, 20 to 30 feet; 4, Clinton and Medina shale, 70 feet; 5, Quartzose Medina sandstone, 20 to 30 feet; 6, softer Medina sandstone, 120 feet above water level.

that the crumbling away of this exposed Niagara shale could have been at any less rate than that; so that the estimate of about ten thousand years for the date of that stage of the Glacial period in which Niagara River first began its work of erosion at Lewiston (an estimate which is supported by a great variety of facts independent of those relating to the Niagara gorge) is strongly confirmed by this new line of evidence.

So far as I can see, the only question of serious doubt that can be raised respecting this calculation will arise from the possible supposition that, when the eastern drainage over the Niagara channel began, the land stood at such a relatively lower level as would reduce the height of the fall to about half that of the present escarpment at that point; when it might be supposed that a protecting talus had accumulated which would interrupt the lateral erosion for the indefinite period when the drainage was being drawn around by way of the recently opened Lake Nipissing and Mattawa outlet. Then, upon the resumption of the present line of drainage, with the land standing at nearly its present level, the talus may have been undercut, and so fallen down to leave the upper strata exposed as at present. But there does not seem to be sufficient warrant for such a supposition to make it necessary seriously to entertain it, while the objections to it are significant and serious. First, the present narrowness of the river at the water level is such that it does not give much opportunity for enlargement after the first formation of the gorge; secondly, the Niagara limestone at the mouth of the gorge is so thin (stated by Hall to be twenty feet thick) that it would not form a protecting talus, even at half its present height.

P. S.—Since the above was written there has been reported in the papers an immense fall of rock from the east side of the gorge, near the head of the Whirlpool rapids. The estimate made of the amount is one hundred thousand tons. If that estimate is correct, it is a very impressive illustration of how the average fall of material from the side of the gorge is occasionally increased by a single instance. In making our calculations above, the total amount of material annually falling off from the portion of the side of the gorge under consideration amounted only to 1,237 tons, while the amount of material was 611 cubic yards. But the 100,000 tons which came off in a single slide a few weeks ago would be equal to twenty inches in thickness from the whole face of the cliff, where our estimate was only a quarter of an inch.

N. B.—In the diagram (Fig. 6) extend the Niagara shale (2) up to occupy lower two layers of (1), thus making Niagara limestone (1) half as thick as now.

A PIECE of skin which the authors maintained to be of great antiquity and to have belonged to the extinct mylodon or ground sloth, found in a cave in Patagonia, was recently exhibited to the London Zoölogical Society by Mr. A. Smith Woodward and Dr. F. P. Moreno.

ABUSE OF PUBLIC CHARITY.

By BIRD S. COLER,
COMPTROLLER OF THE CITY OF NEW YORK.

TEN per cent of all the human beings who die in New York city are buried in Potter's Field at public expense; but the records of organized charity, official and semiofficial, show that less than one per cent of the living are paupers or dependent persons. There are two explanations of the difference between the number of living poor and penniless dead. The chief one is that abuse of public charity has grown to such proportions that the city has become the Mecca of the chronic idlers and tramps of the entire country. It is easier for an industrious and shrewd professional beggar to live in luxury in New York than to exist in any other city in the world. No magic wand of ancient fable was ever more potent to unlock the gates of castle or prison than the name of charity is to open a way to the public treasury. The liberal and well-nigh indiscriminate giving of the money of the taxpayers for the relief of sickness and poverty has been commanded by law, sanctioned by custom, and approved by public opinion until the possibility of checking or reforming the abuse grows more and more remote as the burden increases and the evil results multiply.

The city of New York gives annually to public charity more than $5,000,000, and contributes indirectly $2,000,000 more. Of the money raised by taxation for city purposes proper (State taxes, interest, and county expenses eliminated), almost twelve per cent is properly chargeable to relief of poverty and sickness. Of this expenditure more than $3,000,000 is paid to private institutions and societies over which the city authorities have no control or supervision. The payments are made in compliance with the provisions of acts of the State Legislature. The only provision in these laws that enables the city officers to protect the treasury from fraud is a clause under which the comptroller is permitted to verify the bills of the institutions for the care of committed persons. There is a constitutional safeguard against outright swindling of the city, in the requirement that charitable institutions shall be inspected and their bills approved by the State Board of Charities, but the system is open to many abuses where the public officers are powerless.

The present comptroller of the city has found that a number of alleged charitable institutions and societies receiving money from the city apply nearly all their funds to the payment of salaries of officers and employees, while their relief work is very limited and of doubtful character. Other societies, he found upon investigation, really encourage professional beggars without in any case relieving deserving poor. A few cases were so flagrant in their abuse of public charity that the further payment of city money to the societies was refused. In one case he found that a society which claimed a board of directors and numerous officers was really managed by one person, who in one year had received $1,500 from the city and $70 from all other sources, and had expended $1,300 of the amount for salaries and $40 for the relief of the destitute.

The Department of Public Charities, for the maintenance of which the sum of $1,941,215 is appropriated for the year 1899, is controlled entirely by the city. The balance of the $5,000,000 appropriated annually for the same general purpose is divided among more than two hundred societies and institutions managed by corporations or private individuals. In theory none of these private institutions is supported by the city, the municipality merely paying to them a fixed sum, which is supposed to be supplemented by private donations. In reality nine tenths of them could not exist six months without the money they receive from the public treasury. Very few of these semipublic charities have an income from all other sources equal to the appropriation from the city.

The city pays for the support of a child in a private institution the sum of $110 a year, and the average allowance for the maintenance of an adult is $150. The percentage of children among the dependent persons is almost three to one, so the $5,000,000 public charity fund would feed and clothe more than forty thousand persons each year if applied directly to that purpose. In the distribution of this great sum of public money, however, fully $2,000,000 of the amount is absorbed in the payment of salaries and expenses, and therein exists an abuse of public charity so great that the present comptroller of the city some months ago appealed to the Legislature for relief in the form of legislation which would enable the local authorities to stop payments to many societies. There are numerous small institutions, some of them having the indorsement and moral support of leading citizens, that spend from sixty to eighty per cent of all the money they receive in the payment of salaries, and in one case discovered by the comptroller the expenses absorbed ninety-four per cent of the total income of the society!

There is no evidence that any of these societies are deliberately dishonest in their dealings with the city and the public. They are as a rule conducted by men and women whose motives are good, but who have no experience or practical knowledge to fit them for the management of a charitable institution. They are easily imposed upon by professional beggars, and in most cases fail in their well-meant efforts to reach and relieve the deserving who are in actual need. Most of the small organizations that waste public money in misdirected charity are controlled by women of eminent respectability, but with no knowledge whatever of the details of the work they have undertaken. The result in many cases has been that they employ enough help to absorb the bulk of the money received without realizing that they are doing more harm than good.

The city does not spend its own money cheaply. Of the appropriation of $1,941,215 for the support of the Department of Charities for the current year the sum of $529,626 is allowed for the payment of salaries of commissioners and employees. No private business could long endure if conducted on such a basis. Some of the institutions where hundreds of homeless waifs from the streets are cared for—institutions semipublic in character, managed by men of more than local reputation as experts in such work, societies founded by men and women whose lives have been devoted to doing good—show by their annual reports that more than half their income is paid out in salaries. One institution that received $30,000 from the city in 1898 and $20,000 from all other sources, reported a salary account of $31,000. Another, receiving $100,000 from the city and $120,000 in donations, had a salary account of $115,000. For every five persons supported by public charity there are three persons employed on salary in the work of relief. Of every five dollars paid out by the city treasury to relieve the sick and destitute, two dollars is absorbed by the salary and expense accounts.

The theory of the law under which city money is paid to private charitable institutions is that they relieve the municipal authorities of the care of a certain number of persons who would otherwise become public charges to be maintained in the hospitals, asylums, or homes owned by the city. It is also a popular theory that young children who have become a public charge will receive better care and training in a home controlled by a private society than they would in a public institution. Appropriations and legislation are also obtained by private organizations on the representation that for every dollar paid to them by the city or State an equal amount will be contributed by founders and subscribers. This representation is not always true, and in many cases it happens that when a society begins to receive money from the city private contributions fall off. When the city authorities first took up the question of caring for homeless and destitute persons and found that they had to deal with a grave problem, some of the private charitable institutions were already in existence and came forward with offers to share the burden. At that time it was considered a good business arrangement for the city to use private societies in the work of relief. This plan, it was expected, would save the city considerable money, because the officers of the societies would contribute their services, and the cost of applying public charity to necessary relief would in that way be reduced to a minimum. That expectation has not been realized. With the rapid increase of necessity and demand for public relief the expenses of administration of the societies have increased out of all proportion to the work accomplished. In the beginning the city authorities shirked a public duty, and by giving city money to private persons who were willing to relieve them of a burden they invited the creation of new societies and a steadily increasing demand for more funds.

Of the two hundred and twenty charitable societies that receive money from the city more than one hundred have been organized during the past ten years. The records of the finance department and the annual reports of these new organizations show that many of them have received from the city sixty to ninety per cent of all the funds they have handled, and that almost the same percentage of their total income was charged to expenses, the chief item of expense in every case being the payment of salaries to officers. Year after year the promoters and officers of these small organizations appear before the city authorities when the annual budget is to be passed, and, attempting to excuse the poor showing they make, say, in pleading for a larger appropriation, "We hope to do better next year." The most liberal-minded defender of indiscriminate public charity would find it difficult to excuse the existence of some of these societies.

There are scores of small organizations helping to spend public money that are unknown to the general public. In fact, some of them are never heard of except when their officers appear before the Board of Estimate once a year to ask for more money. There is a society, organized for the purpose of supplying clothing to shipwrecked sailors, which for several years obtained a small appropriation from the city. When the officers requested an increase of the amount allowed, the city authorities asked for some particulars of the work done. The report submitted in reply showed that the society had received, in addition to the money obtained from the city, several donations of second-hand clothing and one box of wristlets (knit bands to be worn on the wrists); had sent to a sailor shipwrecked on the coast of Oregon a suit of underwear, a pair of hose, and a rubber coat; to a crew wrecked on the reefs of Florida some shoes and oilskin caps. There was no report of relief or clothing supplied to a sailor or any other person in the city or State of New York, but there was a charge for salaries that almost balanced the amount received from the city treasury.

Another of the minor institutions is a society that is engaged in an original method of charitable work. The agents of this society, or the members themselves, go out into the slums of the city on Sunday mornings and gather in a number of tramps. The homeless wanderers are assembled in a room hired for the purpose and supplied with a warm breakfast, after which they are compelled to listen to a sermon and a lecture. They are then allowed to depart and live as best they can until the following Sunday. For a number of years this society has received a small appropriation from the city on the ground that it is a useful public charity. To all of these small societies, no matter what may be their alleged field of charitable work, city money is appropriated without specific knowledge of the exact purpose to which it is applied. By legislation or petition, backed by the influence of prominent citizens, scores of these petty organizations, some of them merely a fad or whim of an idle man or woman, have been placed on the list of semipublic charities to be aided at the expense of the taxpayers, and there they remain year after year without so much as a serious inquiry as to their merits or the work they accomplish. The city authorities who grant the appropriations do not and can not know how the money they give to such societies is to be expended, because they have no legal authority to investigate the conduct of such institutions. The city officers, therefore, are not to blame. The fault seems to rest primarily upon that condition of public opinion that is cheerfully tolerant of any fraud committed in the name of charity, and secondly upon the members of the Legislature who vote without question or investigation for all legislation asked for by any benevolent person or society.

To the large charitable and correctional institutions of established reputation, to which children or pauper adults are committed by the local authorities, city money is appropriated on a business basis. A fixed sum is paid for the support of each committed person, and the taxpayers may know what they are getting for their money. While the city authorities can not regulate the expenses or salaries in these institutions, they know that the city is paying for a specific service and that the work is performed. That it might be done better or more cheaply need not concern them. But to the institutions and societies that do not undertake to support dependent persons, but engage in indiscriminate charitable work, the giving of city money is as doubtful a method of relieving the deserving poor as throwing coin in the streets.

The appropriation of city money made for 1899 direct to two hundred and fifteen charitable and correctional institutions and socities amounts to $1,784,846. The appropriations from the excise funds to institutions that support pauper children and adults will slightly exceed $1,000,000. The county of New York pays to State and private charitable institutions for the same period the sum of $118,682; Kings County, $82,669; and Richmond County, $4,845; all of which comes out of the general treasury. The money received for licenses for theaters, concert and music halls, amounting to $50,000 a year, is divided among eighty-two private societies and institutions. This makes an aggregate of $3,000,000 paid out of the city treasury annually and expended under the direction of private organizations. With the exception of less than $100,000 it is all appropriated under the provisions of special acts of the Legislature, or sections of the city charter, and the city officers have no control whatever over the methods of expenditure or the work undertaken by the societies that receive the money. Under such a system the possibilities for abuse of public charity are well-nigh unlimited.

These direct appropriations of money do not represent all of the city's contribution to the cause of charity. The property of all the charitable institutions and societies is exempt from taxation and from assessments for public improvements. The tax commissioners report that the assessed value of the property of such organizations is $70,781,990. At the present rate of taxation this means a loss to the city of more than $1,400,000 a year. The assessments upon the same property for public improvements exceed $100,000 a year, which is paid by the city. These exemptions materially affect the tax rate as well as the bonded indebtedness and annual interest charges of the city, so that the yearly contribution of the taxpayers of New York to charity is nearly if not quite $7,000,000, or about fifteen per cent of the direct expenses of the city government.

Some figures from the budget for 1899 will show the relative cost of caring for the poor. The city will pay for public education $13,040,052; for police, $11,797,596; for the fire department, $4,443,664; for the health department, $1,110,538; for lighting, $2,000,000; for water, $1,450,817; for cleaning the streets, $4,575,800; for parks, $1,729,235; for paving and repaving streets, $2,520,099; and for charity direct and indirect, $7,000,000.

The chief abuses of the present system of public charity are the extravagant expenditures for salaries and the steady and rapid increase of pauperism due to the misdirected efforts of the inexperienced persons who control so many of the smaller societies that receive city money.

One of the oldest and most important charitable organizations in the city is the Children's Aid Society. The report of the treasurer for 1898 shows the following expenditures:

Industrial schools—		
Salaries of superintendent and teachers	$106,265.71	
Rent of schoolrooms	5,119.26	
Books and school supplies	5,178.54	
Provisions	8,509.70	
Clothing and special relief	5,512.56	
Fuel, gas, repairs, etc	20,497.88	
Sick Children's Mission		$655.48
Children's Summer Home		9,405.37
Health Home		8,307.45
Farm for Boys—Summer Charities		2,719.59
Brace Memorial Lodging House		12,914.13
Elizabeth Home for Girls		10,366.33
Tompkins Square Lodging House		7,546.38
West Side Lodging House		9,079.26
East Side Lodging House		1,848.06
Forty fourth Street Lodging House		7,948.56
Fogg Lodging House		1,942.26
Brace Farm School		12,150.64
Reading rooms		402.96
Medical examinations		312.00
Salaries, executive officers		8,659.92
Immigration, fares, food, clothing, etc		30,162.69
Reinvestment, bonds sold		29,902.50
Amount due treasurer, November 1, 1898		435.71
Printing, stationery, car fares, and incidental expenses		3,551.85
		$309,394.79

This shows a total salary account of $114,925.63, or about thirty-seven per cent of the expenditure. The society received from the city $100,764, and from general subscriptions and donations $119,768. The balance of the income was derived from legacies, endowments, special trust funds, and sale of bonds.

One of the private institutions in the city for the instruction of deaf-mutes receives city, State, and county pupils under the provisions of special acts of the Legislature. The report of the treasurer for the fiscal year ending September 30, 1898, shows the following receipts:

Balance on hand, October 1, 1897	$2,885.03
New York State	44,216.74
New York County	27,179.54
Kings County	12,697.05
Queens County	1,217.19
Westchester County	1,060.94
Various other counties	2,727.02
Paying pupils	791.75
Donations	11,754.46
All other sources	613.89
	$105,143.61

The expenditures for the same period were $102,570.64, of which $33,613.56 was for salaries and wages. This is a private institution exempt from city or State control, subject to no governmental supervision except examination by the State Board of Charities, yet ninety per cent of its income is public money, and almost one third of the cost of maintenance is charged to salaries and wages. These two cases are mentioned not in criticism of the work or methods of the institutions, but as representing a fair average of the salary account of all the larger private charitable societies. They also fairly represent the two extremes in the source of their income, one receiving ninety per cent of public money, the other a little more than thirty per cent.

Recent investigations conducted by the city comptroller and supplemented by the agents of the State Board of Charities disclose abuses in the expenditure of public money by certain small societies so flagrant that the appropriations for the current year have been withheld. In these cases the salary account was always the chief expenditure, but it was also discovered that whatever relief got beyond the headquarters of the societies went to professional beggars, who had no difficulty in deceiving the persons in charge. It was found that persons in good health had lived comfortably for months, perhaps for years, on public charity dispensed through private organizations. These professional beggars would obtain food at one place, clothing at another, coal at a third, small sums of money from all three perhaps, then reverse the order of application or appeal to newer organizations if detection threatened. Relief was extended in many instances with little or no effort on the part of the societies to ascertain the merits of a case or the honesty of an applicant.

One small society was found to have expended practically all of the money received from the city in the payment of the living expenses of the person who had the entire management of the organization. The charitable work of a year consisted in the distribution of a small quantity of cast-off clothing and a few bushels of potatoes. The reports of the society contained the names of directors who had never served and knew nothing of the true condition of the organization. They had merely consented that their names might be used as a guarantee of reliability and to aid in the work of soliciting contributions.

One case has been found where a mother and daughter lived comfortably by selling coal given to them by charitable societies. One private institution, now abolished, boarded committed children and received two dollars a week from the city for each child. The children were fed on fish and potatoes at a cost of forty-four cents each per week. After these facts were discovered the city authorities could not remove the children until the Board of Health condemned and closed the building under the provisions of the sanitary code. The minor abuses in the way of aiding undeserving persons extend to nearly all the private societies that receive city money. Those that exercise care and have been long established are often deceived by professional beggars.

After his investigation of the subject the city comptroller established in his office a bureau of examination for the purpose of placing a check on the many small societies that indulge in indiscriminate charity at the expense of the city, but he soon found that he was powerless to correct all abuses. The present condition can not be corrected and public charity placed upon a practical basis and limited to the real necessities of the deserving poor until the city government begins to deal with each society and institution upon its merits. Changes and reforms to the present system will come in time, but progress will be slow because charity is a valid excuse at the bar of public opinion for the reckless expenditure of city money, and for that reason it appeals strongly to the average politician and lawmaker. Charity will cover with a mantle of commendation a multitude of abuses and crave pardon for gross frauds. It is the pastime of the rich and their gratuity to the poor. The magic of the word seems to move a Legislature and open the treasure vaults of city and State.

ALASKA AND THE KLONDIKE.

A JOURNEY TO THE NEW ELDORADO.

By ANGELO HEILPRIN,
PROFESSOR OF GEOLOGY AT THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,
FELLOW OF THE ROYAL GEOGRAPHICAL SOCIETY OF LONDON.

II.—SAN FRANCISCO OF THE NORTH.

A FIRST impression of Dawson, in August, 1898, could not be other than one calculated to bring up comparisons with strange and foreign lands. As we saw it, approaching from the water side, it persistently suggested the banks of the Yang-tse-kiang, or of some other Chinese river, on which a densely apportioned population had settled. Hundreds—one is almost tempted to say thousands—of boats were lined up against the river front, and so packed in rows back of one another that exit from the inner line was made possible only by a passive accommodation from the outside. There were steam craft, house-boats, scows, and a variety of minor bottoms, ranging from the hay-packed raft to the graceful Peterboro canoe. Many had canvas spread over them, giving house quarter to those who preferred the economy of an owned estate to the high-priced cabins of log huts and hotels, and the purity of the open air to what was at least considered to be the polluted atmosphere of the stable city. It would be far from the truth to assume that this floating population

Dawson and Klondike City (South Dawson) in September, 1898.

was composed exclusively of men, women, and children; there were dogs galore, abundant by both presence and voice, horses and mules, and an occasional goat betrayed itself munching among hay-packs and the usual combination of simple and hard things which make up goat food. One canvas bore the tempting inscription "Hot and Cold River Baths," several carried legends of variously designated laundries, and a few even invited to "Board and Lodging, Cheap." Of course, the word cheap had here a special etymologic significance, and bore little relation to the same form of word which is current in lexicons.

The first favorable impression of dry land in Dawson was tempered by a knowledge that even here were many moist spots. The mud lay in great pools along the main street—First Avenue or Front Street—but hardly in sufficient depth to make walking dangerous. Dogs and goats could alone drown in it. It is true that an occasional wading burro or even a mule would find a dangerously low level, but I am not aware that any in this condition had added to a list of serious casualties. No mention is made in this connection of cats, for, in truth, only two specimens of the feline family had up to this time reached Dawson—one, a blue-ribboned kitten, which was endearingly received as the mascot of the Yukon Mining Exchange.

The Dawsonites are not entirely oblivious to the discomforts of mud, for an effort is being made to block it out with sawdust, of which the three or four sawmills in the town furnish a goodly supply. In some parts a rough corduroy has been attempted, but the price of lumber, two hundred dollars per thousand linear feet, renders this form of construction too expensive for general use, especially in a community all of whose members, female as well as male, are prepared to stem the tide with high-top boots. About one half the street length shows the pretense of wooden sidewalks, but no one has yet recognized a special responsibility for repairs, or seemingly considered that a continuous walk requires a continuous support. Walking is a succession of ups and downs; boards are missing here, other are smashed elsewhere, and the whole walk gives the impression of having been in existence for centuries rather than for the period of a short twelvemonth.

It was not difficult to determine what, perhaps, the majority of the sixteen thousand inhabitants of Dawson were doing at the time of our arrival. They were simply loitering, and the streets were packed with humanity. This was not strange, either, for it must have been difficult to resist the enjoyment of that open sunshine, that soft, warm atmosphere which is the delight of the summer climate of the far North. Never had I experienced anything comparable, and others who had traveled much agreed with my experience. On my way to the hotel, the "Fair View," which had been strongly recommended for its *cuisine* and the circumstance that it was "brand" new in its appointments—having only come into existence a few days before—I caught a good general glimpse of the town, the dominant features of which were registered in the two sides of the main thoroughfare along the river front. A nearly continuous row of one-story, or at the utmost two-story, frame shacks or booths, many of

JUNCTION OF THE KLONDIKE WITH THE YUKON.

them still in canvas form, and most of them supported over the river's bank by pile proppings, built up the river side of this First Avenue. All manner of articles, both serviceable and unserviceable, for the

Klondike business were displayed, mostly in cramped quarters. The variety of things that had in so brief a period found their way to this region was truly astonishing, and one marveled at the mental ingenuity which spirited some of these articles to a *champ de vente.* Surely nothing but "manifest destiny" could have placed a mammoth's molar on sale for a hundred dollars, when it was thought that a period of starvation was reigning in the town. And yet almost alongside of it were posters announcing that four loaves of bread could be purchased for one dollar—in another place "six loves" for the same price—and that "half an ounce" of gold dust, the equivalent of eight dollars, would gain admission to the best seat witnessing a boxing and wrestling contest.

In addition to the booths doing a regular merchandise business, there were those whose masters ministered to a specialty—druggists and doctors, photographers, auctioneers, and brokers of one kind or another. "Bartlett Bros., Packers" served the inner core of the gold regions by means of long trains of pack-mules, but they were not the only ones to whom the *cargador* was an officer militant. Dog teams there were as well as mule teams, and the majesty of the law was hardly considered invaded when the former effected a junction with man in the capacity of common carriers. One of the most interesting sights was to me the large number of letters awaiting ownership which were tacked up to the fronts and sides of different buildings, in the most public way petitioning for rapid delivery. My first letter in Dawson was obtained by stripping it from a door-jamb, but it was three weeks before my attention had been directed to it by a friendly discoverer. To obtain anything from the post office was a most exhaustive process, and usually required a long wait, sometimes of a day, or even of two days, before entry could be obtained into the small room where the sorting, distribution, and dispensation of mail matter were being effected. Even when finally issued, this matter was usually of several weeks' antiquity of arrival, the sorting of tons of substance being much beyond the capacity of the few official hands that were engaged in the work.

By far the most imposing side of the street was that which faced the river. Here, at least, were real buildings. The stately depots of the Alaska Commercial and North America Trading and Transportation Companies, with their outer casing of corrugated iron, would have done credit to a town of larger capacity than Dawson, and in regions much more accessible to civilization than the Northwest Territory. Farther on, the signs of a number of well-built saloons —"The Dominion," "The Pioneer," etc.—attract attention, not by the supposition that they are alone in the business, since they are supported by probably not less than two or three score others of their kind, but by their specially distinctive interiors; one of these is embellished inside by a series of four mural decorations in oil or dis-

Arrival of the "Susie" from "down the River."

temper, representing a range of subject from Morro Castle, Havana, to a "Moonlight on the Yukon," for which a resident artist "of promise," whose work was done in an open lot, received the handsome compensation of eight hundred dollars. They were befitting the place which they graced.

A more intimate acquaintance with these saloons made it plain that they were patronized both for the drinks which were sold over the bar for fifty cents or more and for the gaming tables which in open evidence betrayed a surpassingly strong interest in faro, *rouge et noir*, and roulette. Crowds were watching the fortunes of the play at every turn. From the front entrance quite to the rear some of the more favored halls were packed, but with an element that seemed little disposed to disturbance of any kind. While the drinking of spirituous liquors is very largely indulged in, I believe that during all my stay in Dawson only three cases of obtrusive drunkenness were brought to my attention; and of riotism my experience was wholly negative. Life and property are considered safe even in the most doubtful establishments, and it is not uncommon for a man to pass hours in a crowded dance hall with virtually all his possessions, possibly a few hundred dollars, or it may be thousands, carried in the form of gold dust in his trousers pockets. Two main factors are involved in this condition of security or in the feeling that it exists. The first of these is, perhaps, a wholesome dread of the Canadian Mounted Police, whose efficiency in the direction of controlling order is conceded by every one; and the second, the circumstance that the inhabitants of Dawson and of the adjoining Klondike region are not, as is so largely supposed, a mere assortment of rough prospectors, intent upon doing anything for the sake of acquiring gold, but a fair representation of good and indifferent elements borrowed from all professions and stations of life, and not from one country alone, but from nearly all parts of the civilized globe. During my brief stay I stumbled upon "counts," "sirs," military and naval officers, scientists, lawyers, newspaper men, promoters, and others of broad and liberal standing; and if some of these were undistinguishable in external garb from their brethren in mustard-colored mackinaws whose sole resource was digging for gold, their polished and intellectual method was evidence enough that civilization was present in good quantity along the upper Yukon. The fact that there are three weekly newspapers published in Dawson—the Nugget, Midnight Sun, and Dawson Miner, the first two selling for fifty cents a copy and the last for twenty-five cents—can hardly be considered to prove this condition, although favoring it; for, though the substance and especially the typography of the journals are quite good, the demand for reading matter is such that almost anything could realize a subscription list. The long-belated New York journals seem to command a steady sale on the news stands, where one also sees displayed the small and (in our country) gratuitously distributed scenic book of the transcontinental railways put up for fifty cents. The Argosy, Strand, Munsey's, and Cosmopolitan were the ruling maga-

THE MAIN STREET IN A SPRING FRESHET.

zines during my visit, and each of these could be had for seventy-five cents a number.

Regretfully must it be said that the female portion of the population does not sustain the male either in character or diversity. I tried in various ways to ascertain the number of women who represented the community, but failed to obtain a satisfactory accounting. A large proportion of those who are in evidence, and perhaps even by far the greater number, belong to the "red" aristocracy, or at least to that side where steady principles are treated with little consideration and respect. I use the word aristocracy advisedly, for it is a notorious fact that an amount of deference is paid to these creatures of shame which is not given to the virtuous or self-respecting woman; and that they themselves, recognizing their standing, are apt to look down upon the rest of their kin, and to even question their proper privileges. A large part of the broadly capacious Second Avenue, together with equally conspicuous sections of the town elsewhere, is given up to the public display of the inmates of neatly constructed log cabins bearing such devices as "Saratoga, "Bon-Ton," "The Lucky Cigar Store," "Green Tree," etc. The number of open houses is probably less than in most mining camps, and far below what it is in some places. In deference to a demand tax of fifty dollars, levied on each member of the profession to pay part costs of two fire engines which had been brought to the town, there was a response of only sixty-nine, and this was considered a sufficiently close representation not to press the matter any further.

A community of this kind must necessarily have its dance halls and places of amusement. The latter consisted at the time of my arrival of four "theatres" or "opera houses"—the "Combination," "Monte Carlo," "Mascot," and "Pavilion," two of which suspended or closed up before the "season" had fairly opened. Ordinarily, the price of a drink at the bar of entrance paid for admission to the performance with seat, and many will agree with me in believing that the admission was fully paid. The acting need not be worse at any theater, and the singing could hardly be surpassed in its eccentricities; yet the performances appeared to satisfy a general demand, as ordinarily the houses were packed to their full capacity evening after evening. Needless is it to say that the performances are not intended for women in good standing, and few such are ever present, unless heavily screened behind the curtains of the "boxes." The plays are all of a low order, but the worst is not much worse than some of the plays that are tolerated in all their nastiness in some of our own legitimate theaters. It is singular and interesting as showing the influence of necessity that a sacred Sunday concert in aid of the fire department was successfully carried through in the capacious halls of one of the most notorious dancing resorts.

There are now two banks in Dawson—the Bank of British North America and the Canadian Bank of Commerce. In the early days of August the first of these was still housed in a tent, and before the end of the month a stately wooden structure with flagstaff, and with commodious quarters for the representing officers and accountants,

Some Mud in the Main Street—First Avenue.

gave dignity to the institution, while it lent style to the corner upon which it was erected. Adjoining it now is the architecturally most imposing but by no means largest building in Dawson—the threestoried, bow-windowed log cabin of Alexander McDonald, the recognized "King of the Klondike"—intended primarily as an office building. It is a truly fine expression of the art of log-cabin building. In many ways one of the most interesting buildings, if such it can be called, was the air space, with canvas top, which adjoined one of the theaters and was used by Signor Gandolfo for a fruit store. There was no architectural quality to commend this space; nor, indeed, was there anything else in its favor, except that it was in the right place and brought both lessor and lessee fortunes. For the privileges of this space of five feet width the occupant paid the handsome rental of one hundred and twenty dollars a month, or twenty-four dollars per single foot of frontage; his profits were, however, such as to justify this payment, and before leaving he confided to me his plan of renting one half of the establishment. Conceive of the character of a store five feet wide, the opposite sides of which are devoted to quite distinct interests! Other sites rent for very little less, and the singular part of it is that much of the rental goes to the pockets of certain assumed owners, whose actual rights are largely in the nature of a "grab" or of squatter sovereignty alone.

Dawson extends up the river for about two miles, virtually coalescing with and taking in what has been euphoniously called Lousetown and also Klondike City. These more southerly parts carry with them certain characteristics which are either wanting in the main city or are there but feebly represented. The closely packed tents remind one of an army gathering or of the furniture of some religious camp meeting; walking between them might almost be considered to be a branch of navigation. Inscriptions on the canvas tell us of certain "brothers from St. Louis" being occupants here, and of "the Jolly Four from ——" occupants elsewhere. Representatives of the press, physicians, and attorneys all have their inscriptions. But the most interesting constructions, picturesque as much as they are instructive, are the elevated platform *caches*, diminutive log cabins, which on high stilts store a multitude of articles in safe keeping and beyond reach of the army of hungry dogs which are everywhere prowling about and carousing upon all manner of odds and ends. Their appearance, especially where they are placed among trees and bushes, is such that the observer can hardly resist the feeling that he is traveling in a region of primitive pile-dwellings—it may be the interior of New Guinea or the forest tract of one of the Guianas.

Dawson, which now owns the right to celebrate its third anniversary, is destined before long to assume a modern garb. It already has its electric plant, and before many months have passed electric illumination will lift the burden of the dark winter night. It is believed, too, that an electric railroad for freight and passenger service will be constructed in the course of the present year into the

Dog-Team Express—Dawson.

heart of the adjoining gold region. The tiresome accounts of bad trails will then be a thing of the past. In its business aspects Dawson does not materially differ from the majority of the boom towns of the United States, though of course it has its peculiarities. In the period of little more than a year it has gathered to itself, besides the usual class of merchants, representatives of a number of professions, such as doctors, lawyers, chemists, and assayers, most of whom, especially of the first two classes, appeared to be doing at least fairly well. Mine brokers, or simply venders of claims, are numerous, but their service does not in most cases sustain confidence; the display of posters announcing "bonanzas" in mining properties may be effective at times, but ordinarily the investor turns either to the Mining Exchange, a reasonably well-conducted private enterprise, or to claim-holders on the ground. The auction of claims at the Exchange was always largely attended at the times of my visits, and the bidding was frequently very spirited. The allowance of a time limit of ten days in which to make an examination of properties purchased and of the titles thereto before payment, beyond a forfeit of ten per cent, was exacted, naturally inspired confidence in the method of the transaction, and there is no question that a considerable number of good properties were parted over the boards here, and with eminent satisfaction to the purchasers.

The practice of medicine is necessarily governed by the laws which are in effect in the Dominion of Canada, and it requires the possession on the part of the practitioner of a diploma properly accredited from some recognized college of medicine in Canada. Graduation with diploma from the best medical schools in the United States is not considered to meet the requirement—nor, for that matter, is the diploma of any but a British school. This restriction also applies in the case of professional trained nurses. A number of cases closely bordering on litigation, and at one time even threatening to bring about international complications, have arisen in connection with practice violating this law; but despite the overwhelmingly large number of foreigners who are resident in the region, and who, it was thought by some, had the right to consult practitioners of their own nationality or choice, there is now a peaceful submission to the reading of the statute. The exaction is in no way intended to legislate against foreigners, but is simply a provision of the Dominion laws, similar to that which requires a "Dominion surveyor" who intends doing official survey work in British Columbia to be properly accredited with a special paper of that section of Canada (as distinguished from the Northwest Territory, etc.). Like the physicians, all surveyors giving out work under their names must be officially licensed from the Dominion, although those not thus certificated are permitted to do office or field work for others who are.

A field of labor that has already been entered upon by women is stenography and typewriting. There has been considerable demand for this kind of work, and there will continue to be much more, but it may be doubted if profits arising from it will ever equal what has been attained in millinery and the sale of fancy dress goods. One of the earliest milliners to come out of Dawson told me at Bennett that she had disposed of a hat which brought her two hundred and eighty dollars (in April, 1898), and its only ornamentation was two

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Louis Seckels
ASSAYER. General Assay-

Facsimile of Part of Yukon Midnight Sun, September 3, 1898.

black ostrich feathers! Such prices are to-day a thing away in the past, but fur capes or circulars are still marketable for three hundred dollars and upward.

Toward a more intimate acquaintance with the methods and lines of business now followed in Dawson we subjoin a facsimile of portions of the advertising page of the Yukon Midnight Sun, bearing date of September 3, 1898.

THE NEGRO QUESTION.

By J. L. M. CURRY, LL.D.,
GENERAL AGENT OF THE PEABODY EDUCATION FUND AND OF THE JOHN F. SLATER EDUCATION FUND; LATE MINISTER TO SPAIN.

THE negro question is not of recent origin. The Iliad of our woes began in 1620, when negroes were first brought to the colony of Virginia and sold as slaves. Slavery antedates history. The traffic of Europeans in negroes existed a half century before the discovery of America. The very year in which Charles V sailed with a powerful expedition against Tunis to check the piracies of the Barbary states, and to emancipate enslaved Christians in Africa, he gave an open legal sanction to the African slave trade. When independence was declared in 1776 all the colonies held slaves. Slavery, said the late Senator Ingalls, disappeared from the Northern States "by the operation of social, economic, and natural laws," and "the North did not finally determine to destroy this system until convinced that its continuance threatened not only their industrial independence but their political importance." In course of years "the peculiar institution" assumed a sectional character. The war between the States precipitated a crisis. President Lincoln began then the work of emancipation. "As commander-in-chief of the army and navy in time of war, I suppose I have the right to take any measure which may best subdue the enemy. . . . I view the measure [the Proclamation] as a practical war measure according to the advantages or disadvantages it will offer to the suppression of the rebellion." Senator Ingalls's testimony is as follows: "It may be admitted that the emancipation of the slaves was not contemplated by any considerable portion of the American people when the war for the Union began, and it was not brought to pass until the fortunes of war became desperate, and was then justified and defended upon the plea of military necessity." The Southern States ratified the amendments to the Constitution under penalty of otherwise remaining out of the Union and in political and military vassalage. The abolition of slavery has the assent of all sane men. Apart from ethical considerations, the subjection of the will, thought, or labor of a mature human being to the whim, caprice, or legal right of another is a gross political and economical blunder, unwise and indefensible. After emancipation came citizenship and enfranchisement of the freedmen, and the punitive measures of reconstruction, which were the outcome of hatred, revenge, desire for party ascendency, and which no good man can now approve. No conquering nation ever inflicted on a conquered people more cruel injustice than the disfranchisement of the most capable citizens and the enfranchisement of liberated slaves. Certain great civil rights are the necessary and proper consequences of freedom. Suffrage is not a natural right, nor a legal, political, or general result of freedom or citizenship. The large majority of citizens do not and can not vote.

The liberation of millions of slaves was the most gigantic and, in itself, one of the most beneficent acts of this century. Nothing is comparable to it as a triumph of the inalienable rights of man. Humanity and justice demanded emancipation. Re-enslavement no one proposes or desires. All would rejoice in the prosperity and progress of the Afro-American, but with freedom came citizenship and suffrage, and these revolutionized our Government. Elements undreamed of were introduced as constituents. When the Constitution and the resulting Union were formed, such a citizenship with franchise was not proposed, and if proposed would not have been listened to for a moment. The most infatuated negrophilist would not stultify himself by asserting that the Union of States would or could have been consummated with the present incongruous, heterogeneous citizenship.

From these and other facts has been evolved what has been called the negro problem. In the discussion, it is best to eliminate all extraneous considerations, all issues which, as the lawyers say, are "*dehors* the record." Government is a very practical business. The end is the securing and preserving the peace, safety, and well-being of the State. Civil government has no mission of general philanthropy. This problem, while of terrific importance in the South, where the black population is persistently congestive, is not, in its ramifications or direct effects, local or sectional. It affects every community and every section. It is of paramount national importance, complex, and involving social, moral, and political considerations. Its gravity can not be exaggerated. It compels the attention and demands all the resources of patriots, philanthropists, statesmen. It thrusts itself, uninvited and unwelcomed, into religious and social assemblies and legislative councils. It is pervasive, continuing, vital. It is better to look it full in the face and give it dispassionate thought.

It need scarcely be said that in this discussion no hostile reference is made to individuals. Some negroes are men of intelligence, integrity, patriotism, and stand on a plane with our best citizens in virtues and mental qualifications.* The gist of this contention is not based on special exceptions, but on the race in the aggregate.

We find in the South the presence of two distinct peoples, with irreconcilable racial characteristics and diverse historical antecedents.

* Such an extraordinary man as Booker T. Washington is an honor to any country and worthy of unlimited confidence and regard.

The Caucasian and the negro are not simply unlike, but they are contrasted, and are as far apart as any other two races of human beings. They are unassimilable and immiscible without rapid degeneracy. Ethnologically they are nearly polar opposites. With the Caucasian progress has been upward. Whatever is great in art, invention, literature, science, civilization, religion, has characterized him. In his native land the negro has made little or no advancement for nearly four thousand years. Surrounded by and in contact with a higher civilization, he has not invented a machine, nor painted a picture, nor written a book, nor organized a stable government, nor constructed a code of laws. He has not suppressed the slave trade, which, according to recent testimony, was never more flourishing. He has no monuments nor recorded history. For thousands of years there lies behind the race one dreary, unrelieved, monotonous chapter of ignorance, nakedness, superstition, savagery. All efforts to reclaim, civilize, Christianize, have been disastrous failures, except what has been accomplished in this direction in the United States.

It need not be disguised, for it is the ever-present, indisputable fact, that while there are alleviations of the unpleasantness, the relations between the negroes and their co-citizens of the Caucasian race are strained and unsatisfactory. The friction, the prejudice, the cleavage, is not between Teutonic and Latin on the one side and Semitic on the other, nor between Saxon and Celt; it lies deeper, yields less readily to palliatives and remedies, and seems a matter of adjustment for the remotest future. It may help to understand the situation if we analyze its causes.

The great revolution suddenly transformed the customs, traditions, and conditions of the two races. Ownership gave way to freedom; compulsory and wage-unrewarded labor to absolute control of person; inequality, inferiority, subjection, to equality in the eye of the law; restrained locomotion to license of movement; kindness, interest in life, wealth, and physical welfare, to suspicion, distress, alienation. With property in man, regulated and enforced by laws in the interest of the master, labor was organized, directed by intelligent control to the development of agricultural resources and to the building up of a society which for refinement of manners, hospitality, and administrative capacity, has elicited praise from disinterested travelers and investigators. The negro, whatever he may have attained from the discipline of slavery, was not cultivated in intelligence, in manual skill, in forethought, power of initiative, in thrift, and the comforts and graces of home life. When freed, many were deluded by deceptive promises. They construed freedom to mean a division of property. Release from bondage led to intemperance and extravagance. Accustomed to control, unaccustomed to self-reliance, having others to think, plan, buy, and sell for them, to supply wants, to watch over them from the cradle to the coffin, many, when left to themselves, reverted to primitive habits, and became idle and worthless. Slavery had cursed the South with ignorant, unskilled, uninventive labor. Freedom did not change its character. The war, liberation of slaves, the sudden extinguishment of millions of property, bankrupted the South. Subsistence, recovery of means of living, rehabilitation, reorganization of those agencies, which are, with intelligent work, the chief means of the wealth of civilized peoples, became the first duty after hostilities ceased. This demanded steady, persistent industry, the change of former methods of agriculture, subdivision of farms, diversification of pursuits, opening of academies and colleges, and establishment of public schools for free and universal education. The contrast between the wealth and prosperity of the North and South presents an appalling picture. Naturally, the Southern people were in despair, and too often they vented their dissatisfaction, their rage, upon the irresponsible and unoffending negro.

Slavery *per se* is not conducive to self-restraint of the enslaved, to high ethical standards, and the best types of human life. When the interest and authority of owners were removed and former religious instruction was crippled or withdrawn, the negroes fell rapidly from what had been attained in slavery to a state of immorality, and, in some cases, to original fetichism. Some remained immovable in their former faith, but many, especially of the younger generation, of both sexes, gave proof of what degeneracy can accomplish in a quarter of a century. It is very common for them to divorce religion and piety. Artificial excitement, passionate emotion, was substituted for a faith which should be the product of a knowledge of and deep reverence for the Word of God. The danger of doing harm, or injustice, restrains my pen from disclosing a mass of disgusting material which could only shock sensibilities and stagger credulity. It is, besides, very easy to magnify our own virtues and others' vices. It is a prevalent mode of religiousness to repent of other people's sins, and to get superfluous merit by showing how others fall short of our attainments. Lowell said, "Everybody has a mission (with a capital M) to attend to everybody else's business," and "to make his own whim the law, and his own range the horizon of the universe." We have all read of the philanthropic Mrs. Jellaby neglecting home and children to sweeten the lot of the unregenerate natives of Borrioboola Gha. Still, testimony, to satisfy the most skeptical, could be adduced *ad nauseam*, from men and women doing educational and missionary work among the colored people, to show the deplorable depths into which multitudes have sunk.

Under the Reconstruction Acts there was a deliberate, predetermined attempt and purpose to put the freedmen in control of the Southern States. The late slaves were enfranchised; the best class of white men were disfranchised. The law presumes that a man or a State intends the logical consequence of acts done. In South Carolina, Mississippi, and Louisiana a majority of the voters, under the coerced policy, were negroes. In other States they were so numerous that a combination with a small fraction of white voters would give the ascendency. In Virginia, a coalition between non-taxpaying white people and negroes, under skilled and bold leadership, accomplished partial repudiation of the State debt. Superadd to this undisguised Federal intent the hungry adventurers who, as governors, judges, marshals, district attorneys, etc., flocked like vultures around the carcass, the horde of persons whose object was to pilfer and plunder, who played upon the ignorance, the superstitions, and gratitude of the negro and made the credulous victims believe that their former masters were not to be trusted in elections, and you have a picture which imagination fails to realize. The negroes, neither by apprenticeship, nor political education, not intellectual culture, were prepared for the boon, and their unscrupulous friends organized them into secret societies and inflamed hopes and expectations of wealth and dominancy. Casper Hauser transferred from a dungeon to a throne would be a fit illustration of this defiance of all the teachings of the past. Suffrage was a wrong to the nation, to the States, to the white and black races, and especially to the negro. Negro suffrage is a farce, a burlesque on elections, and only evil. The negroes generally vote as puppets, as machines, and have not the remotest conception of the character or effect of the act they are ignorantly performing, or of the issues involved in the contest, or of the functions or duties of the officers voted for. Huxley says, "Voting power as a means of giving effect to opinion is more likely to prove a curse than a blessing to the voter, unless that opinion is the result of a sound judgment operating upon sound knowledge." This premature investiture of the negro with suffrage reciprocally provoked alienation, bitterness, strife, and a resolute purpose on the part of the white people not to submit to the misrule and tyranny of ignorance and pauperism, but to resort to all necessary methods to defeat such a result.

It is needless to recapitulate the facts of many thousand years in order to raise the inference of racial difference between the Caucasian and the negro. The immigration to our country is the proof of antagonism of races. The foreigner stays away from the South; so in a large degree does the Northern man. Notwithstanding the unsurpassed climate, the rivers and gulf and mountains, the fertile soil, the varied products, the hospitable welcome, the territory occupied by the negro is persistently avoided. By the census of 1880 the proportion of foreign-born in all the former slave States was 3.5 per cent; in the Northern States about twenty per cent; in eight Southern States, where the negroes abound, there was in 1880 only one and a third per cent who were of foreign birth. Mr. Lincoln, in 1858, in accounting for the repulsion, said: "There is a physical difference between the two races which will probably forbid their living together upon the footing of perfect equality. . . . I am not, or ever have been, in favor of making voters or jurors of negroes, nor of qualifying them to hold office, nor of intermarrying with white people." Absorption, assimilation, is not to be dreamed of. The negro is no nearer common fellowship, equality of association, than he was in 1865. Reconstruction measures, constitutional amendments, sword and bayonet, ecclesiastical anathemas, fulminations of press and pulpit, all power of church and state and public opinion, have not altered, can not alter, what seems ineradicable. Race antagonism reaches deeper than political affiliation. If every negro at the South were to vote the Democratic ticket in every subsequent election, the race division would remain the same.

Can these differences be effaced, alienations be healed, and overshadowing perils be averted? What concerns the patriot is to find a solution for this gigantic and appalling problem. The statesman has not yet arisen, disposed to grapple with the problem, or capable of suggesting a feasible and efficacious remedy. With the least hardship to the negro, proper recognition of his rights as a man, due regard to the just ends of our Government, and the purposes of its founders, some scheme, if possible, wise, adequate, and comprehensive, should be devised. Whatever hitherto has been suggested has been met with opposition and is justly liable to criticism. The most obvious remedy, and which has been tried with some success, is to uplift the race by means of public schools and proper religious instruction. All honor to the schools that train the youth into self-respecting manhood and womanhood! All honor for the efforts that are making to correct the debasement of slavery, to unite faith and practice, to infuse religious life with an ethical Christianity, and to form a moral basis for life and character! The crimes of both races in the South, pushed within the last few years to most brutal atrocities, show that there can be no safety for free institutions, no guarding against savage degradation, if either race be kept in crass ignorance. Both must suffer. It would be some relief from ballot-box evils and perils if the examples of New England and of Louisiana, Mississippi, and South Carolina were followed by all the States. As "universal suffrage has no anchorage except in the people's intelligence," Massachusetts requires of voters a prepayment of taxes, and voting and office-holding are limited to those who can read the Constitution in the English language and write their names. What has been done by States, denominations, and individuals through schools is not discouraging to larger and better efforts, but is a stimulus to and an assurance of excellent results. The plantation system of the South, when land was in the hands of a few territorial magnates, was of very doubtful utility. A bold peasantry is a country's pride, and a small farmer should take the place of the large landed proprietor. If the negroes should acquire and hold more real estate, they would be of more value as citizens, and would have increased interest in the stability of laws, enforcing of contracts, and the preservation of State honor. An enlargement of the number of those who have a solid stake in the well-being of the country would be adding to the ranks of natural supporters of law and honor, and strengthening the true foundations on which the stability of a republican government must rest.

The congestion of the negroes aggravates the difficulties and dangers of the problem. The area of the States holding slaves in 1860 was 901,740 square miles, and of the Northern States, excluding Alaska, 2,123,860 square miles. By the census of 1890, the total population of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia, was 37.3 per cent of negroes and 62.7 per cent of whites; or, including Delaware, Maryland, Kentucky, and Missouri, 30.7 per cent of negroes and 69.3 per cent of whites. The African citizens are localized within a narrow area. A French statesman said, "Cross the Pyrenees and Africa begins." Cross Mason and Dixon's line, or the Ohio and Potomac Rivers, and in a truer sense Africa begins, for south of that line the negroes are massed. It has been nearly forty years since slavery existed, for no one born since 1860 was ever practically a slave, and yet freedom has not diffused the seven million and a half of Africans. Despite all the traditions of bondage, all the misrepresentations of modern literature, all the exaggerated accounts of intimidation and cruelty, the South remains the home of the negro. When he is told that equality, friendship, political sympathy, and good wages may be secured by passing an invisible geographical line, he persistently refuses to be seduced across. Senator Windom, of Minnesota, advocated a plan for distributing by assisted emigration, but nothing came of it. Senator Edmunds, in discussing the Chinese question, said: "The people of Massachusetts would not be hungry for an eruption of a million of the inhabitants of Africa, . . . because they believe, either by instinct or education, that it is not good for the two races to be brought into that kind of contact in that place. . . . The fundamental idea of a prosperous republic must be a homogeneity of its people."

Colonization as a remedy has had many strong advocates. As early as 1800 the Assembly of Virginia, in secret session, instructed the Governor to correspond with the President with the object of procuring a colony to which the negroes could be sent. Jefferson began the correspondence. The Legislature resumed the question, and expressed its preference for "Africa or any of the Spanish or Portuguese settlements in South America" as the place "to which free negroes or mulattoes, and such negroes or mulattoes as may be emancipated," might be sent or choose to remove. In 1805 the members of Congress were instructed to endeavor to procure suitable territory in Louisiana. In 1811, being asked his opinion as to a settlement on the coast of Africa, Jefferson replied that "nothing is more to be wished than that the United States would themselves undertake to make such an establishment on the coast of Africa." In 1813 the Legislature openly and almost unanimously adopted, for the third time, resolutions similar to those of 1800. The same year the Colonization Society was formed, out of which grew the Republic of Liberia. President Lincoln, in his first annual message, December, 1861, referring to the two classes of liberated persons that might be thrown upon Congress for their disposal, recommended "that in any event steps be taken for colonizing both classes at some place or places in a climate congenial to them. It might be well to consider, too, whether the free colored people already in the United States could not be included in such colonization." Congress responded by voting one hundred thousand dollars for the voluntary emigration of freedmen from the District of Columbia to Haiti or Liberia, and later, in July, 1862, gave five hundred thousand dollars for the colonization of negroes in some tropical country beyond the limits of the United States. Mr. Lincoln continued to favor the policy of removal to another country, and five days after signing the above act he read to his Cabinet a proposed order for "the colonization of negroes in some tropical country." Burdened with this great question, amid the exigencies of the mighty war, he continued to push the matter, and had Secretary Seward send a circular letter to England, France, the Netherlands, and Denmark, with regard to colonizing the negroes in some of their tropical possessions. Offers came from the Danish West Indies, Dutch Surinam, British Guiana, Honduras, Haiti, New Granada, and Ecuador. Mr. Lincoln considered the offers from New Granada and an island off Haiti, and even sent a colony to the latter. Again, in his annual message in 1862, he argued for colonization, and asked for an appropriation, but, under the passions of the terrible conflict then raging, the Congress, instead of heeding the request, repealed the former act appropriating five hundred thousand dollars.

The Indians, against their will, were transported, by coercive measures, to allotted lands beyond the Mississippi, but that was before the modern discovery that the United States should grant "fraternity and assistance to all people" under other than republican governments, and that universal suffrage was the infallible expedient for civilizing semibarbarous peoples. President Harrison, in his letter of acceptance, writing on another subject, says, "We are already under a duty to defend our civilization by excluding alien races whose ultimate assimilation with our people is neither possible nor desirable."

Remedies, strong and adequate and feasible, may not be found readily, but there are gentler and quieter agencies which may be used by both races to mutual advantage. The white people, in accepting the legitimate consequences of defeat, in vigorous efforts to restore antebellum prosperity, in establishing schools, in reconstructing shattered society, have done nobly, but they are not without sin. Laws, general and wise and impartial, on the statute-book need for their enforcement a sustaining public opinion, but this has not always been forthcoming. Lawless and violent proceedings, always unnecessary and demoralizing, sometimes as brutal as the crimes which excited horror; harsh and unjust contracts; interferences in elections; false registration and counting of votes, and other acts which the plea of self-preservation did not justify, have evinced the harshness and injustice of dominant power, and have not tended to soften prejudices or make the situation more tolerable. Each race is fortunately improving in intercourse and in dealings with the other, and time and sober judgment are, in a sensible degree, removing causes of alienation which are not inherent and incurable.

"What a blessing," said President Sir John Lubbock, at the late meeting of the International Congress of Zoölogists, "it would be for mankind if we could stop the enormous expenditure on engines for the destruction of life and property, and spend the tenth, the hundredth, even the thousandth part on scientific progress! Few people seem to realize how much science has done for man, and still fewer how much more it would still do if permitted. More students would doubtless have devoted themselves to science if it were not so systematically neglected in our schools; if men and boys were not given the impression that the field of discovery is well-nigh exhausted. We, gentlemen, know how far that is from being the case. Much of the land surface of the globe is still unexplored; the ocean is almost unknown; our collections contain thousands of species waiting to be described; the life-histories of many of our commonest species remain to be investigated, or have only recently been discovered."

THE PHILIPPINE ISLANDS AND AMERICAN CAPITAL.

By J. RUSSELL SMITH.

THAT the Philippine Islands are of value as a place for investment is an unexplained generalization that is now being used to tempt business men. The object of this article is to discuss this generalization. The idea that the Philippine Islands are of importance to us, as a new field for our industrial developments, depends upon two assumptions: First, that we need to go beyond the bounds of the United States; second, that the Philippines offer the best available field for the satisfaction of that need.

As to the first assumption, the occasion and origin of the demand for the retention of the Philippines furnish presumptive evidence that it represents no real economic want of the American people. No one ever thought of it until we heard the boom of Dewey's guns at Manila. The demands that then arose for Eastern territory were the natural result of a just pride in the amazing triumph of our navy. Before the battle of Manila a suggestion that we should take the Philippines and RECEIVE $20,000,000 as a bonus we would have deemed preposterous. Before that battle, one idea was uppermost in the minds of the American people—namely, the development of the American continent. And yet, along with the enthusiasm over the accomplishments of our army and navy, the idea has crept into some minds that we are in need of more land to develop, and that we must find it in the Eastern Hemisphere.

Examination of the internal condition of the United States does not seem to indicate such need. Our exports are an index to our condition. In 1872 we exported merchandise to the value of $522,000,000; in 1898 the amount had swelled to $1,230,000,000, an increase of two hundred and thirty-five per cent. No European nation has shown such progress. Despite their colonial empires, their armies and navies, their chartered companies, their spheres of influence, and all their elaborate paraphernalia, we are competing with them in their own markets. We have pursued a policy the opposite of theirs and are outstripping them in the race for a share of the world's trade. It is not compatible with industrial wisdom to change and adopt the policy of our less successful rivals just as the success of our own policy is being fully demonstrated.

A nation's commercial supremacy rests upon the same principles as a business man's leadership in his trade—namely, superiority of production. It does not require a citation of evidence to say that the producers of Europe are staggering under the burden of their armies and navies. While they are thus handicapped, we have nothing to fear unless we inflict upon ourselves a similar burden. We have succeeded by attending to our own industries, by developing our natural resources, by producing things that the people of other nations must have. That development is but begun. Even England, the ruler of the greatest colonial empire the world has ever known, the greatest manufacturing nation, the mistress of the seas, stands with almost stationary exports. The United States, the nation with a small navy, the nation that never really had a colony, the so-called isolated nation, has come by rapid strides to the point where she is the leading exporter of the world.

There is no reason why the progress of the United States should be checked. England has demonstrated the fact that the nation that has the iron and coal is the commercial mistress of the world. The United States is continuing, and will continue the demonstration. England has but 900 square miles of much-used coal lands, and she gets her iron ore from Spain. We have over 200,000 square miles * of untouched coal lands; an almost continuous bed of iron ore, reaching from Lake Ontario to Alabama.† Beside this great ore bed is the Appalachian coal field, with coal mines in every State between New York and Alabama. There are mountains of iron ore in Missouri and Michigan. By the special lines of lake steamers the iron ore of Lake Superior is taken to Chicago and Cleveland, and thence carried by rail to Pittsburg. There the eastern coal completes the conditions for the most economical production of iron and steel. That gives the United States the basis for our export trade in iron, steel, and machinery. We are capturing the iron markets of the world, and, judging by our supplies, can hold them for ages. As our iron and coal are the basis of all manufacturing industry, continued attention to them will give us the control of the world's trade.

There are many other lines of our internal development that are yet barely begun. Irrigation is an example of this. The report of John W. Noble, Secretary of the Interior for 1891, said, "One hundred and twenty million acres that are now desert may be redeemed by irrigation so as to produce the cereals, fruits, and garden products possible in the climate where the lands are located." That is an area nearly twice as large as the Philippine Islands, and it is open to the American settler, while there is an indication that the Philippines may be inaccessible on account of their climate. Moreover,

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* The last United States census puts our coal lands at something more than 225,000 square miles.

† "This deposit occurs as far north as the southern shores of Lake Ontario, and thence extends in an almost continuous manner through Pennsylvania, Virginia, Kentucky, and Tennessee to central Alabama."—*N. S. Shaler's The United States of America, vol. i, p. 432.*

they are four times as densely populated as is the United States; and while we deem the Chinee so undesirable that we exclude him from our shores, all authorities agree that his race is superior to that of the Malays, Tagals, and Negritos who inhabit the Philippines.

The irrigable area is much larger than the States of New York, Pennsylvania, Illinois, and Massachusetts combined. Those States at the present time are supporting a population of over seventeen millions, and many authorities claim that they will in the future support at least fifty millions. The regions of scanty rainfall that can be irrigated are fairly crusted with potash and other soluble mineral ingredients that nourish plant life, and give to the valleys already irrigated their astonishing fertility. This enables the farmers to support themselves on such small areas that the life is almost a communal one. The irrigated West can sustain a population as great as that sustained on an equal area in the East, or even greater.* For years that dry climate has been a health restorer to the sojourner there. This is not claimed for the Philippine Islands. The building up of this Western empire with its canals and irrigating ditches, its railroads and cities, will absorb a vast amount of capital, and it is a natural and easy line of development for us. Mr. Irwin has said, "To capital seeking investment in a large way, irrigation enterprises in the West offer a most solid, lucrative, and tempting field." † Secretary Noble has said, "No one can now compute the money value that will concentrate in these reservoirs and canals and ditches, carrying water to the fields of the husbandman, and upon which the people must depend for their prosperity." ‡

Five centuries ago large parts of eastern and western England were impenetrable morasses. These have entirely disappeared before the skill of the engineer.

N. S. Shaler says, "The total area of the inundated lands of the United States probably exceeds 115,000 square miles, counting only those flooded areas which are at present unsuited by their excessive humidity for agricultural use, but which may be won to the service by engineering devices such as have been applied in the regions occupied by older civilizations." # This is more than 73,000,000 acres of drainable swamps and marshes. Lands more easy of access have, in the past, so occupied our attention that these lowlands have thus far been almost entirely neglected. They are located

* If we accept the reclaimable area given above as approximately correct, and apply a system of irrigation, it can be cultivated, "and made the happy home of an industrious people more than equaling in number the inhabitants of the United Kingdom of Great Britain and Ireland."—*J. N. Irwin, in Forum, vol. i, p. 742.*

† Forum, vol. xii, p. 750.

‡ Report of the Secretary of the Interior, 1891.

The United States of America, vol. i, p. 382.

along our northern, eastern, and southern borders in close proximity to water transportation and to the large cities of the seaboard. They can be drained, as were the swamps of England. Their fertility will make this profitable, and they will support a large population.

The public highways of the United States are, on the whole, in anything but a desirable condition, and their improvement is a good investment for the commonwealth. We have railroads to build, harbors to deepen, and canals to dig. The United States is young yet, and tremendous tasks await her labor and capital.

In this country, so full of promise for the future, we are still using borrowed foreign capital. In The Forum for February, 1895, Mr. Alfred S. Lauterbach said, "That the people of the United States require European capital for the full development of the great resources of our country there can be no doubt." The same author made a "very conservative estimate," and said that we owed to Europe annually:

"For dividends and interest upon American securities still held abroad, minimum	$75,000,000
"For profits of foreign corporations doing business here, and of non-residents, derived from real estate, investments, partnership profits, etc., about	75,000,000
	$150,000,000"

That is to say, we were paying a five-per-cent interest on $3,000,-000,000 of foreign money.

As to the second assumption: It is claimed by some that we should have the Philippines because they will furnish us the tropical products that we are using in ever-increasing quantities. Two things are revealed in the examination of our needs of tropic products and a comparison of the Philippines with the American tropics: 1. That the Philippines are at a great disadvantage in location. 2. That America is of sufficient area and natural wealth to meet all our needs, and more.

As to location: It is a first principle of commerce to get supplies where they are most accessible. It is about ten thousand miles from New York to Manila, twelve hundred to Havana, and eighteen hundred to the continent of South America. Under these conditions the freight rates must always discriminate in favor of tropic America. The disadvantage of the Philippines is increased by the fact that the ships going from San Francisco or Panama to Manila are compelled to carry their coal three thousand four hundred miles at one stretch—from Honolulu to Yokohama, the most available route. Then, again, a large part of our tropic trade, and one that shows promise of the most growth, is in the green fruits, such as cocoanuts, pine-apples, lemons, oranges, and bananas. Of the last article our imports have doubled every five years since 1865. On account of distance it is not practicable to bring any of these fruits from the Philippines, but there is no limit to the amount of trade that can grow up on the lines that are now beginning to form between us and our southern neighbors.

As to the fitness of tropic America to supply our needs: There are Central America, South America, and the West Indies. An examination of their area and productiveness shows that there is little to induce American industry to control any part of the Eastern Hemisphere. Of the 17,000,000 square miles that make up the Western Continent, the tropics make up 5,000,000 square miles—an area sufficient to make more than one hundred States as large as Pennsylvania; an area nearly fifty times as great as the Philippines. The variety of its productions is scarcely excelled even by the East Indies. There are only two important tropic products imported into the United States that are not already largely produced on this continent. They are Manila hemp and tea, and it would appear that the reason they come from the East is because of present labor conditions there. Manila hemp is a sort of half-wild product that may yet have an introduction to our rich tropics just as the potato was introduced into Europe, and many of our crops have been introduced from Europe. Even the tea plant thrives in the warm regions of America as far north as Tennessee. Small quantities of tea are now grown in various parts of America,* but the cheap labor of the East has made it unprofitable here. We are at the present time getting nine tenths of our tea from India, where Anglo-Saxon care has developed the industry and is fast driving China out of the tea market of the world.

There is a difference when it comes to the two great tropic staples of coffee and sugar. Our imports of these two articles in 1897 were valued at $180,000,000, while the imports of tea were less than one twelfth as much. At the present time nearly all the coffee used in the United States comes from Central and South America, whence also comes the greater part of the world's supply. The declining price of coffee indicates that we shall get it under more favorable terms in the future.

We import about $100,000,000 worth of sugar per annum.† Approximately two fifths of it is beet sugar and comes from the continent of Europe, and the rest is cane sugar from scattered sources in the tropics. Only one sixth comes from the Eastern Hemisphere. We are getting sugar from Europe, not because it is the natural development of the industry, but because those countries are willing to give an export bounty on all that is exported. This makes

* United States Report on Commerce and Navigation for 1897. † Ibid.

exportation possible. Meanwhile the American sugar industry is left to unprogressive and slovenly methods, but it needs only a reasonable addition of capital and labor to enable it to supply the markets of the world. An Englishman of much experience in the sugar-growing colonies of Great Britain says that by the introduction of improved methods all the sugar that we use in this country could be grown on one half of the little island of Porto Rico.* This would cause heavy complaint from the sugar-cane region of Louisiana, and from those sections of our country that are beginning to hope for a future in the beet-sugar industry. Certainly America can supply herself in this particular.

India rubber is another of our tropic imports that promises to increase in importance with improvements in our ability to use it. Nearly the whole supply comes from the American tropics. There it thrives everywhere. We are importing it from almost all of our sister republics, and although it responds readily to cultivation and yields a profitable crop,† the main supply is yet taken from the wild trees of the forests. Like the other products it waits for the capital which it will well repay.

By a comparison of the average yields per acre of the leading tropic imports with the amounts of those imports, we shall find the area of the territories that are in cultivation to meet our present needs.‡ In 1897 we imported into this country from all sources the crops that would be yielded by 1,400 square miles of coffee, 30 of bananas, 40 of cocoa beans, 60 of India rubber, 10 of oranges; a total of 1,540 square miles. Add to that the area that will be needed for our sugar, and the result does not equal the whole of Porto Rico. The area of Porto Rico is less than 4,000 square miles. Multiply these crop areas by ten, to make allowance for crop rotation and for the time taken for new plantations to come into bearing. The result will be less than 40,000 square miles, a territory not half as great as the area of the West India islands. They in their turn do not comprise the fiftieth part of the area of tropic America.

When the time comes that American industry needs to develop more lands, there they lie. They are our opportunity. They have an almost virgin soil, because we have been too busy with our own internal development to give them needed attention. They need

* W. Allyne Ireland, in an address before the University of Pennsylvania.

† See Coffee and India-Rubber Culture in Mexico. By Matias Romero, late Mexican minister to the United States.

‡ The average yields of tropic produce were made out with the assistance of the Cyclopædia Britannica, Coffee and India-Rubber Culture in Mexico (Romero), and statistics obtained at the Philadelphia Commercial Museums. The amounts of the imports were taken from the United States Report on Commerce and Navigation for 1897.

capital, and we have been borrowing money abroad to meet our needs at home. Their inhabitants are idle for lack of employment; they will respond to our capital. The United States is the natural market for the West Indies; they lie close to our shores, and when the Nicaragua Canal comes they will be but islands in an American lake—parts of the industrial unit of Greater America. They can give us the things that are needed to round out our consumption, and we can do the same for them.

It is illogical and unlike American shrewdness to go seven thousand miles for tropic lands when an equally valuable, a more valuable, area is within seven hundred miles of us. The comparison becomes even more striking when it is remembered that the control of the Philippines brings to us a burden of problems from which industrial development in this country is free.

The Government at Washington may spend our millions and establish government in the Philippines, but will American capital go there? Will our citizens invest their money seven thousand miles away while tropic America is so much nearer, and is, moreover, an equally rich and far more extended field? This does not assume the conquest of American regions. It is not necessary to have governmental control in order to profit by the industries of a country. The conditions of modern industry prove this most conclusively. But for this fact the progress of the world would have been much less rapid. We have an example of this in American railroads: they have been largely built by English capital; the same is also true to a greater or less degree of many of our other industries. What England has done in North America without governmental control, we can do in Central and South America when our industrial condition demands new areas to work over. By the modernized Monroe doctrine our supremacy in this hemisphere is assured, and we have the guarantee of a clear field. Our interests are also furthered by our friendly relations with the American peoples and by our nearness to them.

The American policy of our forefathers is the one for us, even from the industrial point of view. America is an industrial unit, an economic unit, full of undeveloped possibilities that await the hand of American enterprise. Our resources can abundantly provide for our material needs. The continent is controlled by the most ingenious of all the races, and is dominated by the highest political ideals known to man. What need have we to reach out across seven thousand miles of ocean to take lands populous with millions of barbarians?

THE PHYSICAL GEOGRAPHY OF THE WEST INDIES.

By F. L. OSWALD.

III.—REPTILES AND FISHES.

THE present fauna of our planet includes many varieties of mammals and reptiles, and a few kinds of birds, that are found only on certain islands—a fact which seemed rather to justify the once universal belief in the origin of species by separate acts of creation.

A different theory of explanation has, however, been suggested by the discovery of fossil remains, proving the former existence of closely allied forms on continents where their battle for existence had to be fought against beasts of prey and competitors for a limited food supply.

The supposed products of an island genesis by the fiat of supernatural agencies, demanding recognition in mental penance and the payment of tithes, may thus be simply animal Crusoes, favored by the positive or negative advantages of their surroundings.

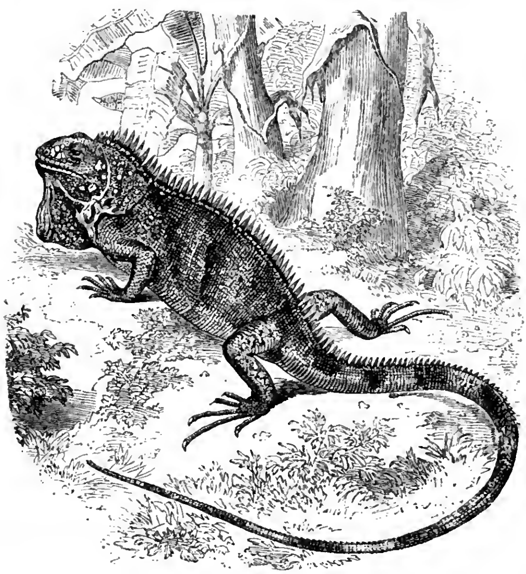
The dodo, in its struggle for survival, would have had no chance against South American tiger-cats. Not one of the twenty-odd species of Madagascar lemurs could have held its own against the competition of the African daylight monkeys.

Yet there was a time when night apes and large ground birds seem to have had things all their own way, the world over, and Central America may have afforded a chance for existence to several species of reptiles which at present are found only on the West Indian islands.

The Cuban bush tortoise (*Emys nigra*) is found only in the forests of Santiago and Puerto Principe, and there only on the south coasts. It is the most sluggish creature of its genus, and does not seem to have had enterprise enough to crawl around the sand belt of Cape Maysi and colonize the jungles of the north side provinces. It is as helpless as a hedgehog, *minus* its bristles. The darkeys of the Cuban planters crack its armor with home-made hammers, and the *tortuga prieta*, or prieta, as they call it for short, forms a factor of holiday *menus* as frequently as 'possum pie in southern Georgia.

Swift-flowing rivers bear it away as they would a floating log, and it is wholly incredible that its ancestors should have crossed the Caribbean Sea in quest of a more congenial home; but it is possible enough that its eggs may have been ferried across on one of the driftwood islands which the Sumasinta River often tears from the coast swamps of southern Mexico and carries into the current of the Gulf Stream. The evolution of the South American giant cats was probably the death warrant of its continental relatives, but in Cuba it had no four-footed enemies except the *hutia*, or jungle rat, that now and then destroys its eggs.

An equally favored islander is the grayish-yellow rock lizard, abounding in the uplands of Cuba and Hayti. The lizard-killing cranes of Honduras have not found their way to the Antilles, and the *lagartilla* still basks in the sun that once smiled upon the indolence of the naked Lucayans.

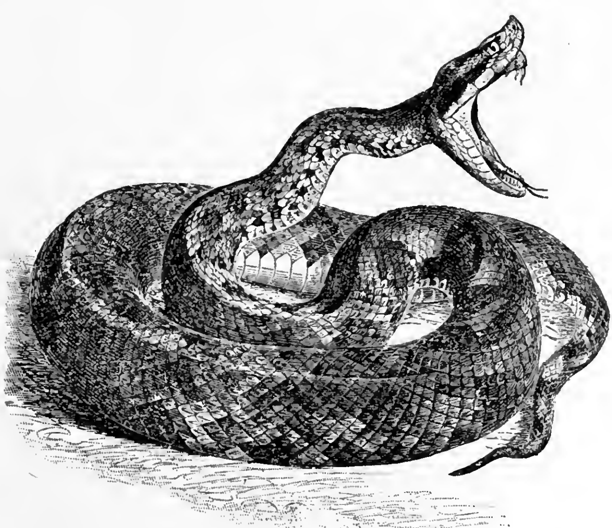


Iguana.

The *toco*, or Cuban hornbill, however, devours small reptiles of all sorts, and the West Indian tree lizards have become almost as nimble as squirrels. They dodge behind branches and wait to ascertain the origin of every flitting shadow, but from imminent danger save themselves by a swift descent, followed by a bold leap into the thickets of the underbrush. Their courtship is quite as grotesque as that of the strutting bush pheasants. The males will swing their heads up and down and puff up their throat-bags till their skin seems on the point of disruption, while the objects of their rivalry sit blinking, reluctant to risk an open manifestation of preference. Some gorgeously beautiful varieties are found in Jamaica: greenish-blue, with a metallic luster, and rows of bright crimson spots, as if the design of protective colors had been patterned after the flower shrubs of the tropics.

The word *iguana* is of Mexican origin, and rarely used in the Spanish West Indies, but the animal itself is—for culinary purposes, though the Haytian negroes do not go quite as far as the mongrels of Yucatan, where iguana farmers fatten the defenseless reptiles with cornmeal, in wickerwork baskets, that are brought to market as a New England poultry fancier would fetch in a crateful of spring chickens. But, prejudice aside, there is no harm in an iguana fricassee; the meat is white and insipid, but takes the flavor of every spice, and is far more digestible than such hyperborean delicacies as fried eels and pork fritters. There are two species—one in eastern Cuba, with spines all the way down to its tail-tip, and in Hayti a smaller one, with a smoother tail, but with an exaggerated throat-bag and wattles like a turkey gobbler.

Lagartos vastecos, or "tree alligators," the Cuban creoles call the scampering forest dwellers, that attain a length of four feet, and can stampede foreigners by leaping to terra firma with an *aplomb* that scatters the dry leaves in all directions. If chased, they will take to water like frogs. They are first-class swimmers, their throat-bag serving the purpose of a float, and once in the ripple of the stream are hard to keep in sight, as they have a trick of keeping their legs close to the body and navigating by means of their submerged tails. Like the rainbow hues of the coryphene (miscalled dolphin), the bright colors of the iguana soon fade after death, and the shriveled greenish-brown specimens of our taxidermists give no idea of the appearance of the living animal in the sunlight of its native land. The *Iguana tuberculata* (eastern Cuba) is velvet-green above, with saffron flanks, ringed with blue, black, and brown stripes, and the pet specimens, basking on the porch of a coffee planter, can challenge



FER-DE-LANCE.

comparison with the paroquets that flutter about the eaves of the outbuildings like swifts around a martin box.

Cuba has also acclimatized a horned frog, and one species of those curious half-lizards whose shapes may have suggested the dragon fables of antiquity. The "basilisk" (*Cyclura carinata*) is only half a yard long, but can erect its crest and raise its pronged tail in a manner that will make a dog leap back in affright. It has no goiter-bag, but the skin of its throat is elastic, and can be made to swell out like that of the East Indian cobra, while its multiplex spines vibrate ominously. The little monster is, nevertheless, one of the most harmless reptiles of the tropics, and subsists on succulent leaves, with occasional *entremets* of small grubs and insects. In that case, however, Nature has rather overdone its efforts at protective ugliness, and the creoles kill the poor simulator of terrors as the Mexican rustics would a horned toad.

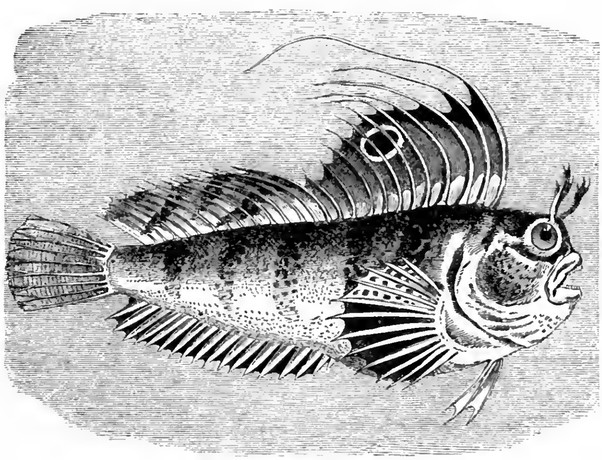
A plurality of the zoölogical immigrants of the West Indies seem to have come from Mexico, and it is a suggestive fact that the number of reptiles steadily decreases from west to east. Cuba, with its western headland approaching the east coast of Yucatan, thus came in for a lion's share of lizards, tortoises, and ophidians.

Hayti, though only one fourth smaller, experienced a seventy-five-per-cent discount, and all natives and travelers agree on the *curiosum* that there is *not a single species of serpent* on the island of Porto Rico. Trinidad, with an area of only fifteen hundred square miles, but laved by the giant current of the Orinoco, boasts twenty-eight species of land serpents, besides several pythons and swamp vipers. The Trinidad museum of venomous ophidians does not, however, include the dreaded fer-de-lance, which infests the woods near Samana Bay on the south coast of San Domingo. The *Bothrops lanceolatus* is larger than a rattlesnake, and its bite, though not always fatal, causes fearful inflammation, but its aggressive disposition has been greatly exaggerated. Like most venomous serpents, it is a sluggish brute, relying on its ability to crouch motionless till its prey comes in range, then get in a snap bite and shrink back to wait till the virus begins to take effect, and the victim, in its fever spasms, betrays its helplessness by those eccentricities of conduct which are apt to be misinterpreted by the dupes of the "serpent-charm" superstition.

The fer-de-lance is found also on the islands of Martinique and Santa Lucia, where the natives counteract its virus with a decoction of jungle hemlock, and the basis of its grewsome reputation seems to be the fact that it does not warn the intruders of its haunts, after the manner of the cobra or the rattlesnake, but flattens its coils and, with slightly vibrating tail, awaits events. If the unsuspecting traveler should show no sign of hostile intent he may be allowed to pass unharmed within two yards of the coiled matador, but a closer approach is apt to be construed as a challenge, and the *vivoron*, suddenly rearing its ugly head, may scare the trespasser into some motion of self-defense—he may lift his foot or brandish his stick in a menacing manner. If he does he is lost. The lower coils will expand, bringing the business end, neck and all, a few feet nearer; the head "points," like a leveled rifle, then darts forward with electric swiftness, guided by an unerring instinct for the selection of the least-protected parts of the body.

And the vindictive brute is ready to repeat its bite. For a moment it rears back, trembling with excitement, and, if felled by a blow of its victim's stick, will snap away savagely at stumps and stones, or even, like a wounded panther, at its own body.

A very curious adaptation of means to ends in the modification of the virus is its swiftly fatal effect on birds. A stricken child, though half crazed with fear, may run a distance of three miles before paralysis begins to impede its motions; a squirrel will escape to its nest in the top of the tree, only to come forth again and topple down



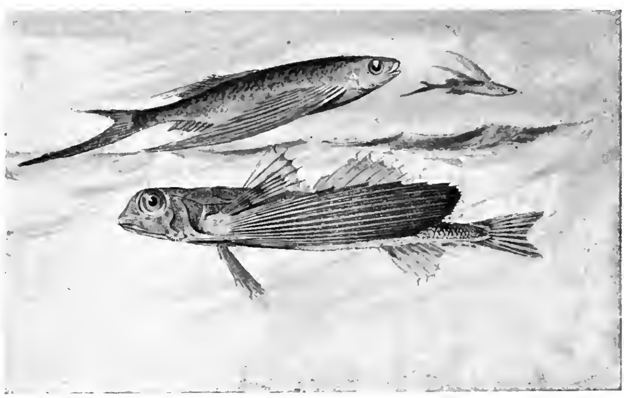
Butterfly Fish.

in its delirium; but a bird drops as if he had swallowed a dose of prussic acid. Serpent virus is specifically a bird poison; in other words, it acts instantaneously in cases where a few moments' delay would defeat the purpose of the snap bite. Wounded rodents will not run very far and can be relied upon to come out of their holes; but a bitten bird, unless promptly paralyzed, would fly out of sight and drop in distant thickets, beyond the ken of its destroyer. And of all bird-killing reptiles the fer-de-lance is the most destructive. The Spaniards have varied its bill of fare by importing the wherewithal of an occasional rabbit stew, but during the preceding ages it had to subsist on poultry, like a popular circuit preacher—the *hutia* rat having developed a talent for avoiding its haunts.

The alleged *horror naturalis* of serpents is perhaps not more deep-rooted than the aversion to cats; at all events, the West Indians have overcome it sufficiently to prefer rat-killing snakes to tabbies.

In thousands of rancho cabins a pet serpent of the genus *coluber* may be seen gliding noiselessly along the rafters, or slip through the crack of a floor plank to reach the penetralia of the basement, where the death shriek of rodents soon after announces the result of its activity. Aristocratic creoles relegate it to their stables, but the tenants of numerous backwood *casuchas* furnish it a cotton-stuffed bed box, and reward its services with a weekly dish of milk. There are several species of large river serpents, and one true boa, the Cuban *matapollos*, or chicken-killer, that attains a length of eighteen feet, and has been known to use its supernumerary coils for the purpose of cracking the ribs of a hound flying to the assistance of the barnyard rooster.

In addition to the above-mentioned jungle tortoise there are several land turtles of the genus *chlemmys*, and thousands of cheli-



Flying Fish (*Exocœtus volitans*); Flying Gurnard or Flying Robin (*Cephalacanthus volitans*). (From Baskett's Story of the Fishes.)

donians are annually caught on Samana Bay, southern Porto Rico, St. Vincent, the Isle of Pines, and the north coast of Matanzas, Cuba. Those of Santiago Bay have gradually been exterminated, but a large number of West Indian fishing waters are practically inexhaustible. A specialist like Agassiz might haul nondescripts from scores of Haytian coast rivers, and the angle fishers of the Cuban sierra brooks can hook an equally interesting reproduction of an Appalachian species.

"Some of our companions had to eke out a haul with crawfish," says the traveler Esterman, "but our own string of sundries included a puzzle for naturalists. We had caught some twenty brook trout, absolutely indistinguishable from the species found in the head waters of the Tennessee River. Where did they come from? Had they crossed the Gulf of Mexico and ascended the rapids of half a hundred rivers, or had Nature copied her own handiwork in such details as the small dark dots below each red spot, and the occasional breaks in the lines of the silver-white keel streaks?"

The perch of the forest rivers include several nest-building varieties, and the sportsmen of Kingston, Jamaica, often amuse themselves with target practice at a species of rock fish that come clear out of the water and bask, like coots, on the harbor cliffs.

With every mile farther south the number and variety of the finned aborigines become more infinite, and the fishermen of the estuary of San Juan de Porto Rico alone catch pompanos, mullets, cavalli, red snappers, chiquillos (a kind of sardelles), sea bass, dorados, skip-jack, angelfish, skate, ray, sheepshead, garfish, torpedo-fish, devil-fish or giant ray, cobia, hogfish, croakers, shark, and coryphenes.

The tiger of the sea, the great white shark, occasionally visits the harbor waters of Cuba, and has been known to seize barefooted peons, surf-bathing horses in the next neighborhood of Morro Castle, and drag them under so suddenly that their companions were unable to account for their disappearance till the foam of the breakers became flecked with blood.

That champion of marine man-eaters is as smooth as a hypocrite, and hides its double row of horrible fangs under a slippery nose, while the little butterfly fish tries its best to disguise its helplessness with a crest of spiny fins. Its length rarely exceeds four inches, and it can be handled with impunity, but its spines are just rigid enough to entangle it in tufts of gulf weed, and in company of equally tiny sea horses and goldfish, it can often be seen in the aquariums of the Jamaica seaport towns.

[*To be continued.*]

A STUDY OF LUIGI LUCCHENI (ASSASSIN OF THE EMPRESS OF AUSTRIA).

By CESARE LOMBROSO.

THERE is not an enlightened person in the world who does not deplore the anarchist crime committed last summer by Luccheni in Geneva upon the unfortunate Empress of Austria. With grief is associated the duty of inquiring what could have been the origin of a misdeed which besides being cruel had the vice of being absurd, falling as it did upon a poor woman near the tomb, who was ready to welcome death, and who had no political influence, by an assassin who had not suffered any offense from her or from her government, and who further had the impudence to boast of his crime as if it had been a heroic act.

We begin our inquiry by seeking for an explanation of the act by means of a study of the person of the murderer in conformity with the rules of the anthropological school.

Luigi Luccheni is the illegitimate son of a Parmesan servant now living in America, and her master, who lived in the Parmesan territory, a priest, unbalanced and intemperate, who sent her when she was pregnant to Paris to be confined. There she abandoned her newborn babe to a foundling asylum. The child was sent thence to his native country and placed, till he was nine years old, with a Parmesan family named Monici, of whom the father was a shoemaker, very poor and intemperate, and the mother immoral.

Fig. 1.—Luigi Luccheni.

After he was nine years old he was put with a family named Nicasi, good people, but very poor—peasants, or rather mendicants, so that he too became a mendicant, wandering with his comrades through the streets and pilfering till he was thirteen years old. It appears from what Dr. Guerini, of Parma, writes me that during this time he had epileptic fits. When twelve years old he went to school, where he appeared bright but impulsive, and on one occasion in his anger destroyed the portrait of the king.

From the age of fourteen to that of nineteen he was a servant, and had two masters, and wandered in Liguria, Switzerland, and Austria, where he was arrested, sent back to his country, and prohibited from showing himself in the east. He then entered the military service, where he conducted himself very well, incurring only light punishments for assaulting a comrade and for helping a sergeant get out of the barracks at night. He was so liked by his superiors and comrades that when, three years afterward, in 1897, he left the army, Captain the Prince de Vera engaged him as his servant. In this service he exhibited great affection for children, and, what is strange, he was so good a monarchist that he was scandalized that at the commemoration of the deceased Cavolotti, in Naples, the orator was permitted to praise him as a political man without interruption from the delegate.

One day, irritated because he had been denied some permission, he abruptly took his leave, declaring that he was not born to be a servant, and returned to Switzerland to work as a marble polisher. But even from Switzerland he kept continually imploring his old employer to take him back, declaring in a letter which revealed symptoms of a persistent delirium that "he probably would not receive him again because he did not go to mass"; which indicates substantially that he had not that repugnance for the anti-anarchical life of a servant which he manifested previously and afterward.*

Whether all at once or not he became an extreme anarchist. He signed and composed anarchist hymns. Suspected by his comrades of not being zealous enough, and also perhaps of being a spy, he decided to strike a blow against some prince; he chose the empress as his victim possibly because he had suffered his first annoyance in Austria. He, who had never killed a fly, had a rude instrument prepared—a file; practiced for a considerable time, perhaps a month, at striking with it, and having committed the crime, tried to escape. When stopped by two citizens he did not resist, and behaved in a very different way from common criminals, therein exhibiting a tinge of insanity. He, for example, although he knew French very well, denied it and demanded an interpreter in the interrogations. He sang and laughed continually, and was glad that he had dealt his victim a good blow, and that he had struck deep with the instrument, boasting that he had used a file instead of a dagger. He was, besides, solicitous of publicity, declaring to the reporters and the judges that he had done the deed all alone, that he had left his captain to accomplish his idea, that he had been an anarchist for thirteen years, etc. In two ungrammatical and very long letters to the journal *Don Marzio*, in Naples, chosen evidently because he had seen it at his master's, he declared that he was not a criminal born, as Lombroso would have it, nor a madman, and that he had not been incited by misery but by conviction, because, if all would do as he had done, middle-class society would soon disappear. He knew that this single assassination would be of no avail, but he had, nevertheless, committed it for an example.

He wrote to the President of the Swiss Confederation that he would rather be tried at Lucerne, because the death penalty was in force there, and repeated the statement to the judges; he wrote to his master that he was more worthy of him than ever; he replied to the reporters and the judges who reproached him with having killed

* It appears that he afterward made the strange request for an anarchist to be appointed guard of the prison, and was irritated when it was denied. (See A. Gautier, Le procès Luccheni. Vienna, 1899.)

a helpless woman, that as for that, if she had been a child, but a prince, he would have killed her all the same. At another time he said, in a wild way: "I killed her because she did not work; whoever does not work should not eat, and I was not going to work for her"—a reason which would be as good for the slaughter of several million persons.

Curious and important is the remark of Luccheni that "Crispi would not have killed her because he was a thief"; an evident proof of the complete lack of moral sense in anarchists,* who like primitive men confound the crime with the deed, and regard criminality as a sort of merit, a seal of fraternity; which demonstrates that the anarchistic practice, if not its theory, is an equivalence of crimes.

When asked if he had never committed blood-crimes, he replied that he had never had anything to do with courts, not even as a witness—which was found to be true—but "I entertained the idea this time, and acted upon it."

Luccheni is a man of medium stature, about 1.63 metre, with very thick, light chestnut hair, stout, with dark-gray, half-closed eyes, roundish ears, heavy eyebrows, voluminous cheek bones and jaw prognatic, low forehead, very brachycephalic (cephalic index 88). He has, therefore, a number of characteristics of degeneration common to epileptics and insane criminals. On the other hand, his handwriting, with its minute characters, especially in the writing of past years, indicates a mild feminine disposition, with little energy of char-

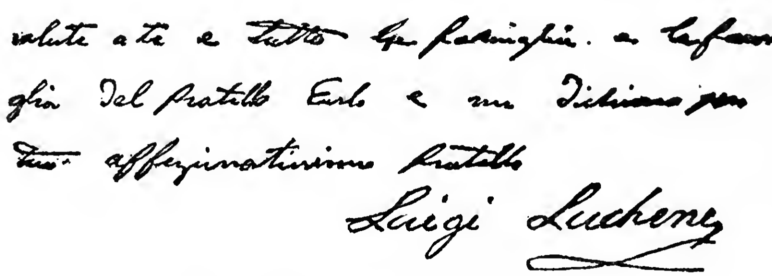

salute a te e tutta la famiglia. e
glia del fratello Carlo e mi dichiaro per
tuo affezionatissimo fratello
Luigi Lucheny

Fig. 2.—Extract from a Letter by Luccheni.

acter. This is especially seen in an autograph of 1896, which was procured for me by Dr. Guerini, who got it from his patient (see Fig. 2). This characteristic, which was extremely conspicuous in Caserio when he was near his crime, was also apparent in the assailant of General Rocha. I have likewise observed it to be very conspicuous in epileptics and hysterical persons; and it corresponds, according as they are in their psychical spasm or out of it, with a real double per-

* See my Delitto politico, Part III, and Gli Anarcici, second edition.

sonality provoked by their disease. In one, as I have shown in *L'Uomo Delinquente*, they write signatures that cover a whole page in their larger diameter, while the signature in the normal state is often smaller than the average (see Fig. 3).

The same double personality that is apparent in the writing is attested in the psychology. We have seen that Luccheni was kind to children, that he was a good servant, characteristics quite opposed to the anarchistic nature, and a genial companion; a man who in Africa was enthusiastically fond of military life; who, a little while before, when he was in the service of the captain, had expressed extreme monarchical sentiments; and finally, when he had become an anarchist, again asked his master to be restored to his service. This double personality is another of the essential characteristics of hysteria and epilepsy.

I have recently studied an epileptoid degenerate who has a sound mind, and, at least in his normal state, is quiet and gentle. But as soon as he has taken hardly more than ninety grammes of alcohol (96° proof) he becomes a wild anarchist, with fierce impulses and hallucinations, of which he has no recollection two hours afterward, or even charges them to his comrades. In this case a double personality is revealed, the demonstration of which is completed by alterations of the visual field and of the touch.

We have, then, in Luccheni a degenerate and probably epileptic person descended from an alcoholic father. Although he affirms that he is not insane or a criminal born, he is a little of both, for he is epileptic and hysterical, so that his denial is already a beginning of a proof of disease. Luccheni also confirms what I have tried to demonstrate in my *Delitto politico*—that the most frequent organic cause of similar morbid impulses of a political character is hystero-epilepsy; for not only do the declarations of some of his countrymen point to epilepsy, and the characteristics of degeneration in the skull confirm it, but his inheritance from an alcoholic father and that impulsiveness and that double personality, which make him pass from the gentlest of men to the cruelest, and which is reflected in the macrography alternating with the micrography of the intervals between the spasms, are accumulative evidence of it.

I have demonstrated the hysterical and epileptic basis in the anarchists and regicides Felicot, Monges, and Caserio, and particularly in a vagabond anarchist, full of cranial anomalies, who told me, when I questioned him concerning political reforms, "Do not speak to me of them, for as soon as I begin to think about them I am taken with a vertigo and fall down"; so that it seems to me possible to establish a psycho-epileptic equivalent in extreme political innovators, an equivalent which is further manifest in their vanity, rising sometimes to megalomania, in their intermittent geniality, and especially in their great impulsiveness. There was also latent in Luccheni an indirect disposition to suicide, which I have found in other political criminals, like Oliva, Nobiling, and Passananti,* who, having conceived a dislike for the king, made an attempt on his life; and especially in Henry, who rejected the defense of his advocate and his mother based on the insanity of his father, remarking that it was the advocate's business to defend, his to die; and in that Roumanian who was photographed in a portrait that I have reproduced, in the act of committing suicide.† Luccheni, too, believed he would be condemned to death, and was much disappointed when he learned that there was no such penalty in the canton where he committed the crime.

It may have been morbid vanity that prompted the exclamation he was heard to make, "I wanted to kill some great person, so as to get my name in the papers" (Gautier).

But while an organic, individual cause was good for a third in Luccheni's crime, he was much more influenced by the atmosphere in which he lived. An illegitimate child, left in one of those nurseries which are real nests of crime and graver disorders, then consigned to a very poor and not always moral family of mendicant habits, having learned nothing except to beg and wander, he found such modes of subsistence as he could (notice the uncertainty and plurality of his occupations, indicating lack of assiduity—servant, soldier, marble polisher, and in the beginning peasant); he found, we might say, as the most constant condition the infelicity which radiated around him from every quarter, and, reflecting the worst, urged him to this way of suicide. We should recollect, too, what Frattini said: "Was it hunger brought me to this?" and the anarchist whom Hamon speaks of: "When I began to question the unfortunates of the hospital, it had a frightful effect on me; I comprehended the need of solidarity and became an anarchist"; and as another one said to the same Hamon: "I became an anarchist when I saw my comrades begging for work with their faces bathed in tears, and was indignant over it." Caserio wept when he thought of the lot of his Lombard companions in misery. These criminals by passion, by altruism, are, as Burdeau wrote, veritable philanthropic assassins. They kill recklessly for the love of men.

Epilepsy and hysteria in Luccheni are explained by his abrupt passage from one condition to the other, and by the conversion of factional passion in him into a criminal act. But there are epileptics and criminals everywhere; yet persons thus disordered in Norway and Sweden are not transformed into anarchists; nor in Switzerland

* See my Delitto politico, 1890. † Ibid.

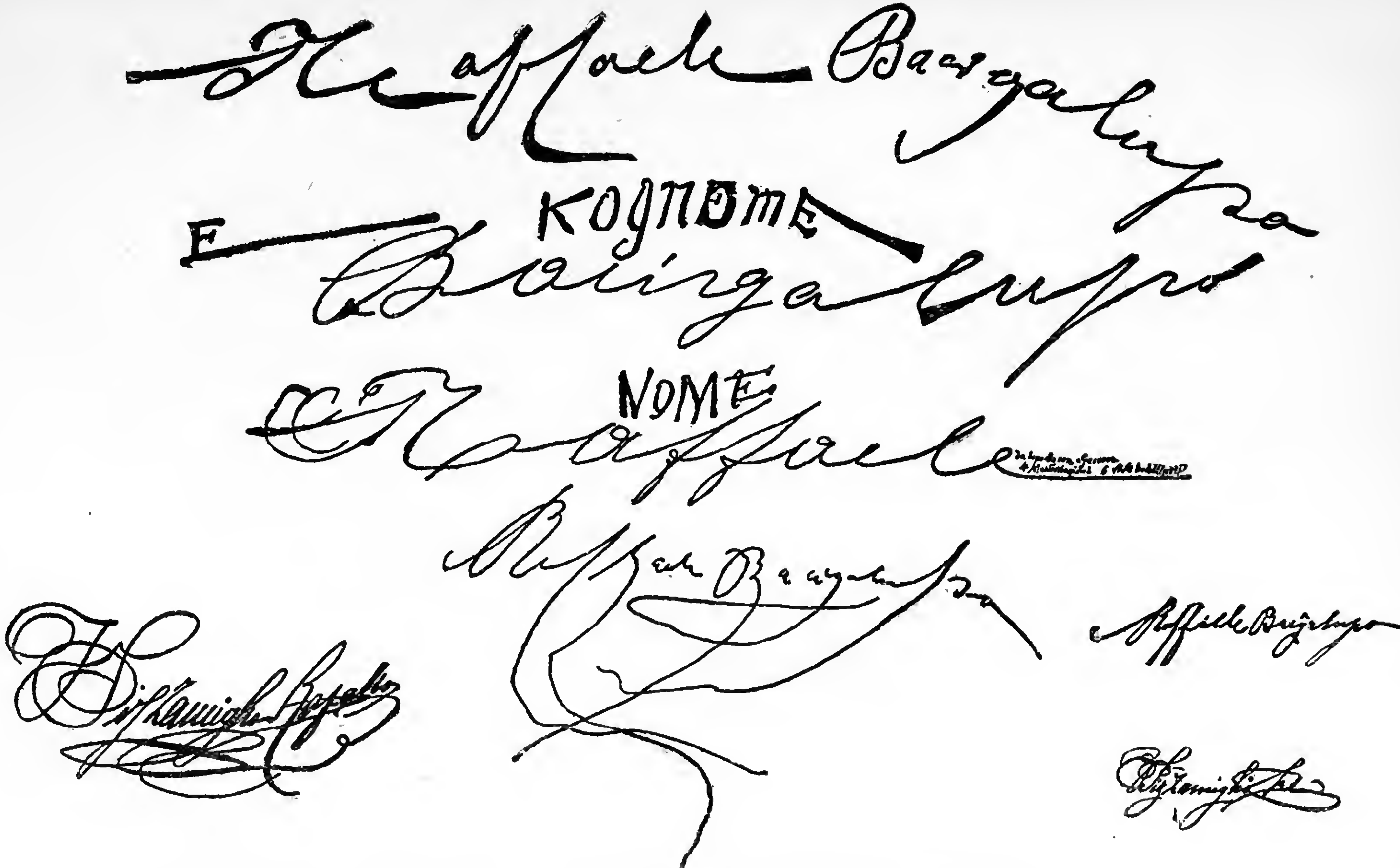


FIG. 3.—MACROGRAPHIC AND MICROGRAPHIC WRITING BY THE SAME EPILEPTIC.

and England, whither people resort from all parts of the world, and where, when anarchy shows itself, it is like a meteor falling to the earth from the extra-planetary regions—wholly isolated and opposed to the world around it.

The most important cause of this transformation is the misery that weighs upon our unfortunate country, evidence of which comes in from every side even upon those who are not miserable themselves. If even in the latest days Luccheni had been living comfortably, he could not, with the excessively morbid altruism that dominated him, have failed to feel this misery, which is so profound and general in Italy.

Not much erudition is required to demonstrate the immense economical embarrassment of Italy as contrasted with other countries when it is known that we pay about five hundred times its value for salt, that bread is growing dearer every day, and that the amount consumed diminishes one tenth every year in these lands.

It was, therefore, with justice that Scarfoglio said in explaining the origin of anarchism, "A good fifth of the population of Italy are still living in a savage state, dwelling in cabins that the Papuans would not live in, accommodating themselves to a food which the Shillooks would refuse, having a vision and an idea of the world not much more ample than that of the Kaffirs, and running over the land desiring and seeking servitude."

It may be added that it is because of this condition—that is, of the defective civilization that results from it—that there is everywhere a weakened revulsion and diminished horror at blood-crimes, so that there are now sixty homicides for every one hundred thousand inhabitants.

We may learn from this what the true remedies should be. The idea of conquering anarchy by killing anarchists is not valid, because every epileptic has another ready to take his place, because anarchistic crimes are to a great extent simply indirect suicides, and because anarchists think as little of their own lives as of the life of another. It is rather necessary to change the direction of the disease by changing the miserable conditions in which it originates.

Not for humanity, therefore, not for exalted social theories, but in our direct interest, we ought to make a complete change. The suppression of a dozen anarchists is like killing a thousand microbes without disinfecting the surroundings that contain milliards of them; it is that we should look, if we want to be better, to breaking up the large estates, and ameliorating the conditions of agriculture and operative industry, and this in the interest of the governing classes.

Typhus, cholera, and plague, it is true, attack chiefly the poor, but from these the contagion extends also to the rich; and from the unhealthy habitations in which the rich man permits beggars to crowd and suffer, the miasm, as if in revenge, is propagated to marble palaces.

That imbecile idea of some European nations, who, instead of disinfecting the medium, find it better to put down the doctors who propose remedies, can not make itself at home except among peoples who are destined to perish.*—*Translated for the Popular Science Monthly from the Archives di Psichiatria.*

TENDENCIES IN FRENCH LITERATURE.†

SUGGESTED BY PROFESSOR DOWDEN'S RECENT BOOK.

By PELHAM EDGAR, Ph. D.

"TO present Victor Hugo in a few pages is to carve a colossus on a cherry stone." Thus Professor Dowden prefaces his ten admirable pages on the great French poet; and with equal appropriateness we might assign the phrase as a motto for the whole undertaking. The subject is too vast to cope with adequately in the limits of a slender volume, the tendencies too complex; and the appeal from human interest, which since the days of Sainte-Beuve and Taine has formed such an important element in scientific criticism, had to be abandoned in favor of generalized views of literary conditions and tendencies necessarily abstract or impersonal in character. Yet, despite these evident restrictions which the requirements of his task imposed upon him, Professor Dowden has produced a work of extraordinary merit, a masterpiece indeed in its kind. If we were not assured that everything which the eminent critic writes is its own sufficient justification, we might be inclined to question the necessity of the present volume, in view of the painstaking and conscientious treatise that Mr. Saintsbury gave to the public some sixteen years ago, and which has deservedly remained until the present time the most reliable English text-book upon the subject of French literature. With no desire to disparage Mr. Saintsbury's scholarly contribution, the present work does in truth supply a need which the earlier book, in spite of its abundant merit, failed to satisfy. It is not harsh criticism to state that Mr. Saintsbury's volume, crammed as it is with a plethora

* To the charges made against me by M. Gautier (Le procès Luccheni, 1899) of having formulated a diagnosis without seeing the patient, which was therefore inexact, and of having described characteristics of degeneration which did not exist, I answer with the pages of Forel, certainly the most eminent alienist of our time, who had him under his eyes during the whole process, and whose diagnosis differs but little from mine.

† A History of French Literature. By Edward Dowden, D. Lit., LL. D., etc. New York: D. Appleton and Company. 1897.

of dates and titles, is at best a compendium for convenient reference, and consequently quite unreadable as a book. Professor Dowden, on the other hand, has conquered the dry-as-dust problem with admirable skill, and the charm of his diction and the easy sequence of his ideas lead the reader insensibly on to the close of a delightful volume. Nor is the book lacking in instructive value of a highly reliable kind, for, in addition to an intimate knowledge of French criticism, Professor Dowden is evidently familiar at first hand with all the more important works of which he treats, and not infrequently proffers fertile suggestions upon debated questions.

Having avowed, therefore, a genuine admiration of Professor Dowden's book, will it be thought a graceless task if, with the proverbial perversity of critics, I endeavor to point out here and there questions of importance that may seem to have merited more attention than the author was perhaps able to afford to them within his restricted space?

The mediæval portion of Professor Dowden's book is valuable not for its originality, but rather as the reflection of advanced modern criticism in France. Therefore, in this brief review the mediæval period may be neglected, and turning to the second book, which deals with the sixteenth century, the first writer of capital importance whom we encounter is Clément Marot. The author has justly indicated the decrepit conditions of poetry in Marot's youth in the degenerate hands of the Rhétoriqueurs, and also the powerful attraction which the allegorizing mania exercised on the poet's early work. His later manner is justly emphasized, and his prowess in the lighter familiar forms of verse; but it is only by inference that we apprehend the comparative neglect of his work until the later classical reaction restored him to favor. Professor Dowden, indeed, throughout his book has hardly conveyed a proper idea of the reactionary shocks by which French literature has invariably advanced. Thus the Pléiade, in the enthusiasm of their rupture with middle-age traditions, were blind to the Renaissance elements in Marot's work, and seeking as they did to elevate poetry to nobler themes and a nobler manner, his easy familiar grace was distasteful to them.

Rabelais, of course, is another "colossus on a cherry stone," and the purport of his message is epitomized in a few luminous sentences. The elements of contrast in the man, and his full-blooded joy in living, which was the sign-manual of the Renaissance upon him, are indicated as follows: "Below his laughter lay wisdom; below his orgy of grossness lay a noble ideality; below the extravagances of his imagination lay the equilibrium of a spirit sane and strong. The life that was in him was so abounding and exultant that it broke all dikes and dams; and laughter for him needed no justification, it was a part of this abounding life. After the mediæval asceticism and the intellectual bondage of scholasticism, life in Rabelais has its vast outbreak and explosion; he would be no fragment of humanity, but a complete man."

Proceeding to the Pléiade, we find its doctrine admirably enunciated, and one point of literary history is well brought out—namely, that to the Pléiade, and not to Malherbe alone, belongs the honor of establishing the bases of classicism in France, the difference chiefly residing in the fact that the programme of the Pléiade was one of expansion in matters of language and prosody, whereas it is precisely in these points that Malherbe and Boileau are concerned with restrictive refinements. Again Professor Dowden, following perhaps in the wake of M. Brunetière, characterizes the conditions of the time as being unfavorable to lyrical expansiveness. "Ronsard's genius was lyrical and elegiac, but the tendencies of a time when the great affair was the organization of social life, and as a consequence the limitation of individual and personal passions, were not favorable to the development of lyrical poetry." These words are ripe with suggestiveness, and duly weighed, they afford the true solution of the oratorical and impersonal character of French literature for two long centuries, when the social *genres* in prose and poetry usurped dominion over the national mind. With our eye then upon the social conditions in France, the often-quoted words "Malherbe a tué le lyrisme" mean nothing more than that he struck a prostrate body.

Before turning from the sixteenth century it should perhaps be observed that in discussing the comedy of that period the author might have amplified his statement of Italian influences by at least a reference to the *Commedia dell' Arte* which we find established in France in 1576, with its traditional repertory of stock characters, whose antiquity ascends to the venerable times of the early Latin farces, and whose survival the work of Molière, nay, even of Beaumarchais, will adequately attest. The last great figure that greets us in the sixteenth century is Montaigne, and we feel a sense of disappointed curiosity when he is relentlessly dismissed at the end of the five pages to which he is entitled here. This singularly modern doubter still smiles inscrutably at us through the misty centuries that flow between us, and we would prefer to loiter with him by the way rather than pass him with a curt nod of recognition. But Montaigne is more important in the history of thought than in the history of literature, so, crossing the threshold of the sixteenth century, we meet the great lawgiver Malherbe, a Moses who really entered the promised land. Professor Dowden is eminently just and appreciative in his judgment of this pedantic and unsympathetic figure, estimating his merits and impartially noting his defects without presuming in his character as literary historian to stamp them as such. Malherbe undeniably eliminated personality from poetry. Shall we regard this as a defect? A century's masterpieces of objective art survive to say us nay, and if the critic's personal sympathies sway him to the side of lyric eloquence, the historian of literature observing without prejudice judges without rancor. "The processes of Malherbe's art were essentially oratorical; the lyrical cry is seldom audible in his verse; it is the poetry of eloquence thrown into studied stanzas. But the greater poetry of the seventeenth century in France, its odes, its satires, its epistles, its noble dramatic scenes, and much of its prose literature, are of the nature of oratory; and for the progress of such poetry, and even of such prose, Malherbe prepared a highway."

And now in the wake of Malherbe so thick do the great names throng that I must perforce touch swiftly only on what seems to demand amplification rather than dwell at length, as it would be much less difficult to do, on the many admirable views the book contains. And first as regards the literary significance of René Descartes. Professor Dowden places himself in accord with the customary views of criticism in assigning to Descartes a preponderating influence on the literary art of his century. "The spirit of Descartes's work was in harmony with that of his time, and reacted upon literature. He sought for general truths by the light of reason; he made clearness a criterion of truth; he proclaimed man a spirit; he asserted the freedom of the will. The art of the classical period sought also for general truths, and subordinated imagination to reason. It turned away from ingenuities, obscurities, mysteries; it was essentially spiritualist; it represented the crises and heroic victories of the will." This sounds reasonable, and is indeed in large measure in accordance with the actual conditions observable in the seventeenth century. Yet there is no doubt that the literature of Louis XIV is more intimately penetrated by the ascetic spirit of Jansenism as conveyed in the famous doctrines of Port-Royal, and it is to Jansenism, and emphatically not to Cartesianism, that the literature of the seventeenth century owes that aspect of grandeur and moral serenity which characterizes it. To quote Brunetière: "Pendant plus de cinquante ans, la conscience française, si l'on peut ainsi dire, incarnée dans le jansénisme, et rendue par lui à elle-même, a fait contre la frivolité naturelle de la race le plus grand effort qu'elle eut fait depuis les premiers temps de la réforme ou du calvinisme." Indeed, the tenaciously religious Jansenist spirit of the "grand siècle" would have been universal were it not that Molière and La Fontaine were apathetically indifferent, nay, sometimes actively hostile, to the general enthusiasm.

Let us, however, examine in all brevity the fundamental doctrines of Cartesianism. The terms are familiar enough. The identity of being and of thought. The objectivity of science. The all-powerfulness of reason. Progress to infinity. Optimism at all times. We can not fail to observe the significance of these categories, and how they contain the germs of almost every great subject debated by the leviathians of the eighteenth century. Yet the nation struggled long before it had strength to shake the incubus of Jansenism from its back, and the stimulating work of Bayle had to be supported by events of actual political significance before the stringent and constraining dogmas of catholicism relaxed their grasp on thought and conduct. The revocation of the Edict of Nantes, the Quietistic movement with its unseemly attendant episcopal quarrels, and finally the actual persecution of the Jansenists, all pointed inevitably in one direction, and stimulating the anti-religious sentiment and opening the flood gates to immorality, induced a potent reaction of Cartesianism in the fundamental theories of the eighteenth century.

In his treatment of Corneille, Professor Dowden " opens his hands only sufficiently to let out a portion of the truth he holds," but what he says is admirable to a degree. Of his diction he writes: " His mastery in verse of a masculine eloquence is unsurpassed; his dialogue of rapid statement and swift reply is like a combat with Roman short swords; in memorable single lines he explodes, as it were, a vast charge of latent energy, and effects a clearance for the progress of his action." This is well said, but hardly indicates how Corneille soared so often in the region of Spanish bombast, or crept among the insipid flowers of Italian preciosity; defects from which Racine's severer Greek taste held him free.

It is refreshing when we come to Boileau to find an English mind impartial enough to do justice to the much-abused " lawgiver of Parnassus." Criticism has for so long deplored his narrowness that we relish an encomium on his good sense. But beyond this there is an opinion which the general reader would be reluctant to admit, but which Professor Dowden has had the courage and the discernment to enforce, when he writes as follows: " But for Paris itself, its various aspects, its life, its types, its manners, he had the eye and the precise rendering of a realist in art; his faithful objective touch is like that of a Dutch painter." Let the incredulous merely turn to the satires to appreciate the scope and truth of the remark. It is difficult to imagine that a more brilliant and effective account of Boileau's work and influence could be presented within so limited a space; yet might not the author have added that whereas Malherbe is the representative of the aristocratic element in literature, Boileau is the first great incarnation in modern times of the bourgeois spirit?

With regard to La Fontaine it need only be observed that Professor Dowden recognizes what French critics with repeated insistence emphasize, the cunning harmonies of his verse.

Much space is of right devoted to Molière, who with La Fontaine has ever been a stumbling-block to English criticism. Professor Dowden voices our national feeling in refusing to consider him as a poet, preferring to emphasize his profound and healthy philosophy of life. *Tartufe* he considers to be an attack on religious hypocrisy merely. Is not the interpretation perhaps correct which regards it as an attack on the intolerance and Puritanism of all religion, even the most sincere?

Once again, in dealing with Racine, the author shows that subtle discernment in which his criticism abounds. He penetrates to the heart of the secret reason for the cabals that harassed Racine in the later years of his dramatic activity, and which doubtless had their influence in enforcing his retirement. Have we ever sufficiently realized that Boileau, Molière, and Racine were waging constant war against a rebirth of the *précieux* spirit which threatened not only society with ridiculousness but literature with ruin? Such, indeed, was the case, and in the eyes of the super-refined coterie that grouped itself round the Duchesse de Bouillon, Boileau and his fellow-workers were innovators of a dangerous and revolutionary order. Does not this idea carry us far from our preconceived notions of the narrow conservatism that dominated the leaders of classical thought? Referring to the disastrous check of Racine's *Phèdre,* the author writes: "It is commonly said that Racine wrote in the conventional and courtly taste of his own day. In reality his presentation of tragic passions in their terror and their truth shocked the aristocratic proprieties which were the mode. He was an innovator, and his audacity at once conquered and repelled." The point of view may seem extreme to us, and this vaunted realism may show pale and weakly when contrasted with the grossness of much of the realism that prevails at the present day, or with the graphic directness of the best examples of the type. But the words ring true if we are willing to accept the refined psychological realism of Racine as equally worthy to the title with the physiological naturalism of our more scientific age. Our whole conception of Racine's art falls into line with this view, and his constant solicitude for an easy and natural intrigue in the structure of his tragedies may be brought home to the same healthy impulse of his mind. Was it not Faguet who maintained that so natural indeed were the processes of his plots that a happy ending would have alone been needed to make any of his tragedies, with some added modicum of wit, in all essential features a comedy that Molière might have penned? Mr. Saintsbury, on the other hand, in dealing with Racine is seemingly swayed by some innate prejudice, or he could hardly have denied the poet a high moral character, merely granting him the possession of great shrewdness and discernment. True passion, he remarks, was not popular with the crowd, but "love-making, on the contrary, would draw, and love-making accordingly is the staple of all his plays." It is against this view, and against Mr. Saintsbury's further opinion that the tragedy of Racine is at the furthest remove from an imitation of Nature, that Professor Dowden makes a strong and timely protest.

While applauding, however, the value of such novel opinions in English criticism at least, we may suspect that in his desire to clinch his arguments the author may have driven the nail too ruthlessly home. And so it would appear when we seek in vain for any statement which contains the shadow of a justification for the existence of that powerful *précieux* spirit against which the greater classicists rebelled. We are too inclined to take Molière's word for it that they were solely ridiculous, forgetting the explicit reserve of his preface—"aussi les véritables précieuses auraient tort de se piquer lorsqu'on joue les ridicules qui les imitent mal." So let us then give the *Précieuses* credit for what they did confer to the advantage of letters amid so much folly, and, weighing the matter carefully, their gift to literature amounts to this: First, amid much linguistic and metaphorical pedantry they were free from the equally damaging and ridiculous pedantry of a labored erudition which pervaded the literature of the day. In the second place, whether we regard it as an advantage or the contrary, their influence made directly *against* the licentiousness of the *esprit gaulois*, and *for* politeness and decency in expression; and as a third count in their favor can we doubt that straining as they did to express the *nuances* of sentiment and gallantry, they were instrumental in stimulating that ardor of mental analysis which is of all things the distinguishing mark of the century? A word finally might have been said with a view to elucidating the inherent divergence of the *précieux* spirit from our own Euphuism, from the Marinism of Italy, or the Gongorism of Spain; a divergence due certainly to the fact that the *précieuses* allied themselves to, and accordingly strengthened, that spirit of social coherence so characteristic of the life and letters of the time in France, whereas the influences of similar movements abroad were more transitory, inasmuch as in some degree more isolated and tentative.

The chapter devoted to the seventeenth century closes with a critical review of the series of great preachers and theologians who have left their mark more or less upon the development of thought, while their literary significance can be comparatively slighted in a history of this kind; and the chapter which discusses the transition to the eighteenth century broaches questions of such large issue that an exhaustive treatment of them was not to be expected. Such are the memorable quarrel of the Ancients and the Moderns, and the *philosophe* idea of perfectibility and human progress. The chapter closes with an account of the great protagonist and pioneer in the warfare against Christianity, the patient, plodding, dangerous Pierre Bayle. So effectually was his teaching absorbed by Voltaire and the encyclopedists that he is read no longer; but low as his flame has sunk, he remains one of the beacons lighting us over the lurid threshold of the century of strife.

We are in safe hands when it is Professor Dowden who guides us on the highways and bypaths of the eighteenth century, but by very reason of his accurate knowledge of the ground whereon he treads we are disappointed when he fails to point out to us some special feature of the landscape. Beauties we could hardly hope to meet with on our journey. There was not sap enough in that arid soil to nourish flowers, or send a flush of living green over hill and valley. The most serious omission is to have left entirely out of account the exceedingly interesting reactionary influences that leaped back and forth across the Channel when Marivaux's romances were devoured in England, and Richardson's *Pamela* was in every French pocket large enough to hold it. It is in itself still an open question which of these two authors exerted the initial influence on the other, although eighteenth-century criticism invariably held that in *Marianne* Richardson found his inspiration.

A great deal of interest attaches to an explanation of the causes of Le Sage's decline in popularity, and this question likewise Professor Dowden has not adequately presented. Le Sage saw the imperative need of mediating between the stilted heroic romances *à la Scudéry* and the grotesque travesties of Scarron and Furetière. Inspired by the picaroon romances of Spain, he produced, amid much inferior work, *Gil Blas*, a masterpiece in its kind. The plot is loose-jointed, the composition *nil*, but the book teems with such verve and vigor that it still pulses with an abounding life when Marivaux and Richardson slumber on our shelves. Yet we must admit that the characters are vagabonds, and the sentiment not without coarseness. Love when not slighted is ridiculed, and metaphysical analysis and moral disquisitions are both refreshingly absent from the book. Hence Le Sage's claims on our consideration as the progenitor of naturalism in romance, but on this account also the reactionary wave against which he had to buffet in his declining years. Marivaux, on the other hand, saw the need of mediating between the stilted heroics of Scudéry and what he deemed the ignoble realism of Le Sage. In this resolve he elevated the characters to *bourgeois* rank, and abandoning the empty love rhetoric of the old romances, he brought the acuteness of an analytic mind to bear on the exploitation of the tender passion; and a conscientious though desultory effort is made to study subtle phases of character in the light of surrounding circumstances. Despite the artificial *précieuse* qualities of his style, and the unfinished condition of his novels, Marivaux enjoyed an extraordinary popularity in his day. The same problem repeats itself on a larger scale when we transfer our attention to Richardson, whose works, translated and popularized by Prévost, were read with the greatest avidity in France. Were not these such influences as Professor Dowden's profound knowledge of English literature would have qualified him to illustrate with more precision than has yet been brought to bear upon them; and was it not in point of fact almost imperative for him to deal seriously with such an important theme in the international literary history of nations?

The pages which Professor Dowden devotes to Voltaire, although brilliant, are not sufficiently suggestive of the extraordinary influence which that most celebrated of writers exercised. It was in no uncritical spirit that Mr. Morley wrote: "The existence, character, and career of this extraordinary person constituted in themselves a new and prodigious era. The peculiarities of his individual genius changed the mind and spiritual conformation of France, and in a less degree of the whole of the West, with as far-spreading and invincible an effect as if the work had been wholly done, as it was actually aided, by the sweep of deep-lying collective forces. A new type of belief, and of its shadow, disbelief, was stamped by the impression of his character and work into the intelligence and feeling of his own and modern times." Nor will Villemain be accused of rapt enthusiasm when he writes, "C'est le plus puissant renovateur des esprits depuis Luther, et l'homme qui a mis le plus en commun les idées de l'Europe par sa gloire, sa longue vie, son merveilleux esprit et son universelle clarté." The strangest fact to contemplate with regard to this unrivaled popularity, this astonishing range of influence, is that it truly constitutes an apotheosis of superficiality. And this in no disparaging spirit of Carlylese disdain for clear ideas around which hang no mists of oracular obscurity, but rather by way of tribute to a heart that beat responsively to human suffering, to a mind keenly sensible of human wrongs. Voltaire rejected the subtleties of metaphysical thought, was indeed incapable of attaining to the heights of speculative contemplation; he was only preternaturally sensitive to the moral defects of this imperfect world, and determined to bend all his efforts to the alleviation of injustice and of crime. As a further concession to his superficiality as a thinker we may frankly admit his incapacity to originate new ideas. His mind indeed was extraordinarily receptive, his intellectual curiosity unlimited, and hostile critics have availed themselves of this very receptivity as a medium of attack upon his originality. They are free to pursue him on that score, but it does not appreciably detract from his greatness in the eyes of posterity to recognize that Bayle before him had preached the doctrine of toleration; that Montesquieu had advocated the abolition of torture and of slavery, and the sanctity of social institutions, or that Boileau forsooth had upheld the dignity of classical formulas in matters literary. It is rather in the mobility of his mind and in the impressionability of his temperament that we should seek for an explanation of a philosophical disturbance in his ideas. It is not an actual mental confusion that I refer to, for his diction is never more limpid than in the expression of his easy personal beliefs; but a certain intellectual inconsistency in his habits of thought makes it impossible for us to hold him down to any definite set of opinions which we can regard as a genuine confession of faith. And this is a vital characteristic of skeptical minds of his stamp, swiftly receptive, and as open as the day to each new intellectual impulse as it arises. Thus we must attribute to his capacity for mental development, as well as to the narrowness of his philosophical range, the many contradictions which his writings exhibit in such matters of intellectual belief as are wont to give a permanent bias of thought to minds less volatile and alert. Are we to regard him as an optimist or a pessimist? a believer in immortality or devotee of annihilation? a fatalist or spiritualist in history? an advocate of free will or determinism? We can not say, and M. Faguet has amused himself with supporting each of these opinions in turn upon its appropriate text, whose clearness is beyond dispute.

If there was one set of opinions to which Voltaire may be said to have somewhat consistently adhered I may instance his vague and insipid deism, which relegated to God the rôle of an absentee landlord in this poor world which he created and governs by absolute law, but in whose affairs he only intervenes when the death rent is to be collected. He infers a creative God from the argument of the clockmaker and the clock, but takes extreme pleasure in showing how sadly the poor machine is out of order. His idea of the social utility of an avenging and rewarding God must of course be regarded as a freak of intellectual caprice, and yet his timid political instincts made him regard the terrorizing influence of the doctrine of hell with some complacency as a restraining force upon the unthinking masses. The story is well known of the atheistic conversation between D'Alembert and Condorcet at Voltaire's table, who summarily dismissed the servants from the room with the remark: "Maintenant, messieurs, vous pouvez continuer. Je craignais seulement d'être égorgé cette nuit." The *Dictionnaire philosophique* confirms the flippant utilitarian point of view, which we must beware of regarding as a personal conviction. "I insist particularly on the immortality of the soul, because there is nothing to which I hold more than the idea of hell. We have to do with a host of rogues who have never thought; a crowd of petty people, brutes and drunkards and thieves. Preach to them if you will that there is no hell and that the soul is mortal. As for me I will cry in their ears that they are damned if they rob me." It is needless to add that convictions of this eminently practical nature did not seriously hamper Voltaire in his anti-religious crusade.

To every branch of letters Voltaire brought the same splendid qualities of mind, and need I add the same defective qualities of conscience and carelessness of the truth when his personal glory or his material advancement were concerned? The sordid pages of his life would weary us in the turning, yet his native generosity and sympathy incline us to charity; and it is wonderful how his never-failing wit can temper his vindictiveness for us, now that the sting has lost its living poison.

I have referred to Professor Dowden's unsatisfactory treatment of the international reactions which characterize the literary history of the eighteenth century. There is another omission which I have remarked in the book on a reperusal of the pages devoted to Rousseau and the encyclopedists. It might have been easily within the scope of a literary story of even moderate dimensions to have more explicitly accounted for the crumbling of the old classical ideal, to have shown that the once impregnable citadel of classical art was rotten at the base, and that those who still defended the imaginary stronghold were themselves the unconscious agents of its destruction. With reference to the irreligious influences of Cartesianism and the philosophical system of Bayle I shall say no more, save that the evident loss in prestige of the traditional religious faith, combined as it was with the rapid decentralization of the sovereign power in the state, must perforce make impossible the survival of literature on the old national basis. Again, in point of pure art a decline was inevitable in connection with the revival of Cartesianism among writers of the stamp of Fontenelle; for their prestige was synchronous with the triumph of the modern party in the famous quarrel; and no student of the *Art Poétique* will fail to appreciate the æsthetical significance of an abandonment of classical standards of taste as an unimpeachable canon of art. Defending as Boileau did the supreme value of reason and good sense, what justification could he have found for poetry unless he had proved to the satisfaction of his generation that poetry better than any other mode of expression could render permanent the promptings of the diviner reason, as witness the eternal monuments of ancient art in the domain of poetry? The triumph of the moderns then turned men's faces in other directions, and whether literary art should henceforward advance or decline, it must at least strike root in a newer soil.

The inroads of sensibility into French literature, as exemplified in Marivaux and Prévost in the thirties, followed swiftly by the rank and file, also wrought havoc in the old classical method, though this fact may not without further reflection be conceded. But in the broad realm of psychological observation, where classic art had reigned supreme, the influx of a certain morbid sensibility strangely warped the mental vision of the observer. Diderot, a veritable sinner himself in this respect, admits as much in an unguarded moment: "L'homme sensible est trop abandonné à la merci de son diaphragme . . . pour être un profond observateur et conséquemment un sublime imitateur de la nature." Every one knows Voltaire's naïve statement which bears condemnatory evidence to the bluntness of his psychology. "La nature est partout la même." And is it not, we ask, this enigmatical typical man, out of space and out of time, for whom the chimerical theories of universal perfectibility were soon to be woven?

It is incontestably true, then, that the character of human observation undergoes a sensible alteration in the course of the century, and that whereas the individual man had been heretofore studied inasmuch as he was in himself of typical value, henceforward not man the individual will be the object of study, but the observation of human relations will usurp the field, and psychological analysis will yield to social investigation.

I would add a word or two by way of conclusion to illustrate how the encyclopedists in their propaganda, aided in part by the coincident influence of Rousseau, established ideals of thought and conduct which were in the most violent contrast to the ideals cherished in the preceding century. Of course, we readily understand that the encyclopedists threw to the four corners of heaven the outworn respect of religious and political tradition. Furthermore, we may ask ourselves what it is which in a sense makes Molière and La Fontaine isolated in their century; and the answer will not be far to seek when we realize that these two alone of all their fellows urged the suspected authority of instinct as a sufficient guide for conduct. Yet how far were not even these bolder spirits from the natural man of Rousseau or of Diderot?

The views of the two centuries concerning the authority of reason seem at first sight to coincide, yet, while bearing Boileau in mind, we can confidently assert that the doctrine of the sovereignty of reason was not established as a principle of thought until the culminating years of the eighteenth century. Pascal's "taisez-vous raison imbécile" indicates how attempered and attenuated by spiritual faith were the dictates of pure reason in his day, and the reason of Boileau, as I have already observed, was strongly tinged with æstheticism. I need not, with reference to eighteenth-century reason worship, go further than to refer the curious of enlightenment on the subject to the masterly works of Morley on the period in question, in which it is precisely this unflinching devotion to reason or unreason (if the sage of Chelsea will have it thus) which stimulates his calm and logical temperament to positive enthusiasm.

A last element of contrast between the centuries is of interest in connection with the habitual mode of thought which Godwin and his political disciple Shelley borrowed from eighteenth-century French sources with reference to the true relations subsisting between laws and morals. The seventeenth-century mind held tenaciously enough to the theory that it is the *moeurs* of a nation that inspire the laws, but the encyclopedists were inspired in their undying hope of amelioration and human progress to perfectibility by the contrary theory that men, after all, are only bad because the laws have made them so.

It may be conceded, then, that these broad relations of literary movements one with the other, the conflict of converging tendencies, and the more evident causes of the growth and decay of powerful manifestations of a nation's thought, are of quite sufficient moment to have merited fuller treatment at the hands of the eminent critic who has in all other respects fulfilled his task so admirably, that having regard to the necessary conditions of the subject, it would be above criticism if anything could be.

THE BOTANY OF SHAKESPEARE.

By THOMAS H. MACBRIDE.

THE universality of Shakespeare is the common remark of critics. Other great men have been versatile; Shakespeare alone is universal. He alone of all great men seems to have been able to follow his own advice, "to hold as it were the mirror up to Nature." On the clear surface of his thought, as on a deep Alpine lake, the whole shore lies reflected—not alone the clouds, the sky, the woods, the castles, the rocks, the mountain path by which the shepherd strolls; not alone the broad highway by which may march the king in splendor the peasant with his wain; but even the humbler objects by the still water's edge, the trodden grass, the fluttering sedge, the broken reed, the tiniest flower, all things, all Nature in action or repose finds counterpart within the glassy depths.

Hence it is that no man, at least no English-speaking man, reads Shakespeare wrong. Everybody understands him. Here is a sort of Anglo-Saxon Bible in which, so far as the world goes, every soul finds himself, with all his hopes, his doubts, his whims, depicted. We are therefore not surprised that everybody claims a share in Shakespeare; rather claims the poet as his own. The Protestant is sure that Shakespeare despised the hierarchy; the Romanist is quite as certain that he loved the Church. There exists an essay to prove him a Presbyterian; another to show that the great dramatist was a Universalist. A volume has been written to prove the man a soldier; another that he was a lawyer, a printer, a fisherman, a freemason; and here are five or six articles to show that Shakespeare was a gardener.*

All this simply means that the poet had a marvelous faculty for close observing; that his vision was accurate, his instinct wonderfully true. It may be therefore worth our while to study for a little this remarkable man from the standpoint of a naturalist, to see how he who so vividly paints a passion can paint a flower; how the man who limns a character, till beyond the photograph it starts to actuality, will catch the essential feature of some natural truth.

We shall nowhere lack for material. The plays are full of references to plants and flowers of every sort. England in Shakespeare's day, as now, was a land of bloom, and the poet but reflects the loveliness of beauty and color spread about him. But he does something more. He is not content with flashes of color and breathings of odor, he goes into detail and gives us the individual plant unmistakably. In his description he shows an exactitude, a discriminating perception that, had it been turned to Nature's problems seriously at all, must at once have transformed the science of his age. But Shakespeare was not a man of science; he was a poet. In his views of Nature he resembles the great poets of the world, notably Goethe; and, like Goethe, he not infrequently outruns the science of his time, uses his imagination, divining things invisible. Moreover, Shakespeare's plants are living things; they form a garden, not a herbarium. They stand before us in multitudes, so that it is difficult for the present purpose to know what to select. We must be content with a few specimen forms brought out in quotations no more extensive than seems necessary to the argument. Of course, there are many plants to-day

* In preparation of this article the author has consulted chiefly the following: John Gerarde, The Herball or General Historie of Plants, 1597; Shakspere, Edward Dowden, 1872; William Shakespeare, Works, Globe edition, 1867; Natural History of Shakespeare, Bessie Mayou, 1877; Shakespeare's England, William Winter, 1894; The Plant-lore and Garden-craft of Shakespeare, H. F. Ellacombe, 1896; The Gardener's Chronicle, sundry pamphlets, and shorter articles.

discussed of which Shakespeare never heard. He does not speak of many sorts of fungi, of slime molds, microbes; he knew nothing about these. The microscope had hardly been invented, and the unseen world was as yet largely personified. And yet Shakespeare has not failed to note the visible signs of some of our microscopic forms. Critics have wasted their time and the patience of mankind in an effort to identify Hebona, the "leperous distilment" poured into the porches of the royal ear. Almost profitless are such discussions. Yet we may note that we have here to do with an effect; the means of producing it need not be too closely questioned. Before the rush of action, the weird setting, the voice of an apparition, the excited audience cares not what the mysterious vial may contain—ebony, henbane, yew, or whether it were entirely empty. What is called for is a speedy and mysterious taking off. Had the scene been laid in Italy, the effect had been reached by the fateful prick of a jeweled pin, some ring upon a Borgian finger whose pressure was the paralysis of death. But the king died of no such curari. Note the symptoms (Hamlet, i, 5, 64–73):

> "The leperous distilment; whose effect
> Holds such an enmity with blood of man
> That swift as quicksilver it courses through
> The natural gates and alleys of the body,
> And with a sudden vigour it doth posset
> And curd, like eager droppings into milk,
> The thin and wholesome blood; so did it mine;
> And a most instant tetter barked about,
> Most lazar-like, with vile and loathsome crust,
> All my smooth body."

These are the symptoms of blood-poisoning, vividly portrayed; of some contagion, communicable by infection. In foul old London Shakespeare had doubtless seen endemic, zymotic diseases of every description, and drew his picture from the life. Royal blood is notoriously unsound, royal habit leaves the porches of royal ears especially exposed. On our supposition the vial need not have contained very much, not even ebony. The dramatist had plenty of mystery ready to his hand, and the Hebona is perhaps intentionally ambiguous. Bacterial diseases were of old called plagues; they fell from heaven. Listen to King Lear:

> "Now, all the plagues that in the pendulous air
> Hang fated o'er men's faults, light on my daughters!"

Or Caliban:

> "All the infections that the sun sucks up
> From bogs, fens, flats, on Prosper fall and make him
> By inch-meal a disease!"

Or they were attributed, as already intimated, to unseen personal agencies:

> "This is the foul fiend Flibbertigibbet: he begins at curfew, and walks till the first cock; he gives the web and the pin, squints the eye, and makes the hare-lip; mildews the white wheat, and hurts the poor creature of earth."

I quote this latter rather also to show the accuracy and compass of Shakespeare's vision. How many people, not farmers, have seen wheat whitened by the blight! And that is exactly the description, white not "to the harvest," but whiter still to sterility and death.

But leaving aside all microscopic forms which may or may not be incidentally touched upon everywhere, we may turn our attention next to cryptogamic plants which are positively defined. The sudden springing of mushrooms, for instance, especially at night, so unreal and yet realities withal, made their creation a suitable trick for Prospero:

> "You demi-puppets that
> By moonshine do the green sour ringlets make,
> Whereof the ewe not bites, and you whose pastime
> Is to make midnight mushrooms, that rejoice
> To hear the solemn curfew."

The "green sour ringlets on the fields whereof the ewe not bites" are "fairy rings." The same thing appears in the speech of Dame Quickly:

> "And nightly, meadow-fairies, look you sing,
> Like to the Garter's compass, in a ring;
> The expressure that it bears, green let it be,
> More fertile-fresh than all the field to see."

Fungi, toadstools, mushrooms, and so forth, are fructifications only; the vegetative part of the plants permeates the soil, feeds on its organic matter, and spreads almost equally, we may assume, in all directions from the point of starting. When now this vegetative growth has accumulated energy to form fruit, the sporocarps or mushrooms rise all around at the limits of activity; hence, in a circle.

The fungi cut a small figure in Shakespeare—i. e., considering their numbers and almost omnipresence. But we must remember that they were at that time studied by few, their significance and interest little suspected. They formed part of the realm of the world unseen; they came and went at the instance of powers unknown, mostly personified, imaginary, a misty population, the thought of which kept for long ages the childhood of our race in terror. Shakespeare saw the forms of unstudied plants, everything visible to the naked eye, and really omitted very little. He speaks of mosses—the lichens were included with them—chiefly as indicative of age in the object in which they rest:

> "Under an oak, whose boughs were mossed with age
> And high top bald with dry antiquity."

Then again he simply touches them, but in such a way as to reveal his full appreciation of their beauty, as in Cymbeline, iv, 2. For the decoration of Imogen's grave the ruddock would bring flowers—

> ". . . bring thee all this;
> Yea, and furr'd moss besides, when flowers are none,
> To winter-ground thy corse."

The "furred moss" to "winter-ground thy corse" is exquisite.

Ferns, though so much larger, so handsome, and in our day so all-attractive, failed generally to impress our fathers.

Butler, writing in 1670, has this to say:

> "They spring like fern, that infant weed,
> Equivocally without a seed,
> And have no possible foundation
> But merely in th' imagination."

Now, as far as Shakespeare was concerned, ferns answered his purpose without seed just as well as with such visible means of perpetuity. His only reference is I Henry, iv, where Gadshill says:

> "We have the receipt of fern-seed, we walk invisible";

and Chamberlain replies:

> "Nay, by my faith, I think you are more belonging to the
> Night than to fern-seed for your walking invisible."

In this connection Ellacombe suggests the doctrine of signatures. The God of Nature had written for us his human children prescriptions all over the leafy world. The remedy indicated by its form its own application. Thus a heart-shaped leaf was good medicine for cardiac troubles, a lung-like leaf was good for consumption, a lungwort in fact, and so a liverwort, a spleenwort, and the like. Gerarde, and, in fact, all the old medical writers throughout the centuries, are full of this. Now, what more natural than that a plant which could thus perpetuate itself age after age by means invisible should be able to confer the much-sought gift of invisibility, the power to disappear and reappear at pleasure? Many people so believed. Shakespeare appears to have been skeptical.

Turn we now to the flowering plants: the amount of material at our disposal, as already indicated, is immense. Shakespeare was evidently a great lover of flowers simply as such. His pages from first to last are ornate with color, almost redolent of roses, lilies, eglantine, with every conceivable metaphor and trope—"the bud of love," the "nettle of danger," the "flower of safety." Their lovely shapes are ever before him; he is spellbound with their beauty. "England itself is a sea-walled garden." Grammatical forms may vanish, if only the flower may live. Compare Cymbeline, ii, 3:

"Hark, hark! the lark at heaven's gate sings,
And Phœbus 'gins arise,
His steeds to water at those springs
On chaliced flowers that *lies*."

The image of the morning flowers, the fiery steeds that drink them dry, shall fascinate us so that we forget the grammar. It will not do to say lie; the word must rhyme with "arise," and further on with "eyes":

"And winking Mary-buds begin
To ope their golden eyes:
With everything that pretty is,
My lady sweet arise."

For the Queen of the Fairies he spreads this sort of a couch:

"I know a bank where the wild thyme blows,
Where oxlips and the nodding violet grows,
Quite over-canopied with luscious woodbine,
With sweet musk-roses and with eglantine:
There sleeps Titania sometime of the night,
Lulled in these flowers with dances and delight," etc.

Such cases reveal the impress, the healthy, happy impress which Nature could exercise on this the foremost man of all the world, the harmony between Nature and Nature's child. All the plants in the last quotation are wild flowers, except the musk-roses, and these are so common in England as to be almost wild. The eglantine was the sweetbrier, said to be wild in all the southern part of the island and popular in the literature of all recorded centuries. Gerarde describes as follows: "The leaves are glittering, of beautiful green color, of smell most pleasant. . . . The fruit when it is ripe maketh most pleasant meats, and banqueting dishes, as tarts and such like, the making whereof I commit to the cunning cook, and teeth to eat them in the rich man's mouth."

The sweetness of the leaf of the eglantine is referred to by Shakespeare in another passage which I venture to quote now for another purpose, to show the accuracy of his description as applied to simple flowers. The lines are from the scene quoted before. Arviragus and Guiderius would bury the swooning Imogen. They think her dead (Cymbeline, iv, 2):

"I'll sweeten thy sad grave: thou shalt not lack
The flower that's like thy face, pale primrose; nor
The azured harebell, like thy veins; no, nor
The leaf of eglantine, whom not to slander,
Out-sweetened not thy breath."

Primroses when pale are the palest of all withering plants. The flowers change color with maturity, especially after fertilization. The paleness of the primrose is the pallor of decay. But the azure harebell—behold it waving on its slender stipe beneath the shade of some great rock—who can look into its delicate cerulean cup again and not bethink him of the blue-veined eyelid sleep that falls upon our human flowers!

The same accuracy of detail is evinced in many other places. Take, for instance, Shakespeare's description of the violet all the way through. It moves him chiefly by its odor (King John, iv, 2):

> "To gild refined gold, to paint the lily,
> To throw a perfume on the violet,
> To smooth the ice, to add another hue
> Unto the rainbow, or with taper-light
> To seek the beauteous eye of heaven to garnish,
> Is wasteful and ridiculous excess."

Nevertheless, we have violets dim, and violets blue, and purple violets, and more particularly "blue-veined" violets, as if the poet looked with a lens into the very throat of the flower which Frenchmen call a thought. "And there is pansies—that's for thoughts." His description of the elm is equally exact (Midsummer-Night's Dream, iv, 1, 47–49):

> "So doth the woodbine the sweet honeysuckle
> Gently entwist; the female ivy so
> Enrings the barky fingers of the elm."

There is nothing better than that, as you may prove by examining the twigs of even some of our American species; the cork elm, for instance. The hawthorn, the cedar, and the pine and the oak especially, are most naturally treated. These are Shakespeare's familiar trees. The cedar of Shakespeare is the cedar of Lebanon, commonly planted throughout Europe since the time of the Crusades. Shakespeare had probably seen specimens in England. He uses it as the type of all that is great and fine. One author thinks he copies Ezekiel, chapter xxxi. The pine was beside him all the while. He knew the secret of the pine knot, and well describes it (Troilus and Cressida, i, 3):

> ". . . checks and disasters
> Grow in the veins of actions highest reared,
> As knots, by the conflux of meeting sap,
> Deflect the sound pine and divert his grain
> Tortive and errant from his course of growth."

Any one who has ever examined the case, or even one who has handled knotty lumber, has seen the wood fiber run around the persistent base of some dead limb, and can appreciate these lines.

All these quotations show that Shakespeare used his own eyes and used them well. He saw the real distinctions of things, the hoariness on the willow leaf. He found character in the oak as in the king, and beauty in both. In many of his notices of natural objects, however, the poet is not the original observer. He often uses current opinions, fancies, dreams, for these also were the realities in his day, quite as much sometimes as oaks and forests. There is concerning plants a sort of orthodox mythology, and thousands of years have sometimes contributed to the reputation born by a single species. A curious illustration is found in what Shakespeare has to say about the mandrake (Antony and Cleopatra, i, 5):

> "Give me to drink mandragora.
> Why, madam?
> That I might sleep out this great gap of time."

Othello, iii, 3:

> "Not poppy, nor mandragora,
> Nor all the drowsy syrups of the world,
> Shall ever medicine thee to that sweet sleep
> Which thou owedst yesterday."

Juliet, reflecting on her proposed entombment in the dark grave of the Capulets, exclaims (Romeo and Juliet, iv, 3):

> "Alack, alack! is it not like that I,
> So early waking, what with loathsome smells,
> And shrieks like mandrake's torn out of the earth,
> That living mortals, hearing them, run mad:
> Or, if I wake, shall I not be distraught,
> Environèd with all these hideous fears?"

The mandrake *Atropa officinalis* belongs to the *Solanaceæ*, and, like others of the family, has narcotic properties. This was doubtless known to Shakespeare, as in the passage cited he compares the mandrake with the poppy. The groaning and shrieking are, of course, the purest superstition. The root of the mandrake was supposed to resemble the human form. The favorite habitat assigned to the plant was the foot of the gallows, and men believed that in some way the bodies of criminals were reproduced in the growing plant; their very pains and cries renewed, especially for him who profanely dared to pull the mandrake from the earth. The curious may consult Gerarde.

These ideas, it is needless to say, are very old; Pliny refers to them, and, if I recollect well, Vergil has his hero pull up some plant amid the strangest of sights and sounds. With these old myths are tied up, perchance, the mandrakes of King James's version. Nay, the superstition still survives; look at the woodcut in

Webster's Unabridged, and you will discover that the artist who set out to illustrate the word mandrake for that somewhat venerable authority was by no means able to free himself from the ancient spell. Credulity is evermore a factor in the compound called human nature. Men love to be fooled, or to find some support for belief in manifest absurdity. There is nothing so silly but has its advocates among men who ought to know better.

A year or two since, a man brought from Ohio to the University of Iowa an innocent five-parted, digitate, black fungus. It was treasured in alcohol. Why? Because of its origin. An honest mechanic meeting with accident lost his fingers under the surgeon's knife. The amputated members were neglected, but presently discovered and duly buried in the garden. The following spring from the "identical spot" uprose a swarthy hand, black without, white within. The hand was a perfect *main-de-gloire* for that sensation-loving community. The matter was discussed in newspapers. A long and careful account of the wonder was prepared, put in print and circulated among the friends of the deceased—fingers! "What fools we mortals be!" For sheer superstition and crass stupidity who may say that the nineteenth century may not yet discount the days of the virgin Queen?

But I said at the outset that Shakespeare had in some instances anticipated modern scientific teaching. To illustrate this in its most striking instance, I am compelled to offer a somewhat long quotation (Winter's Tale, iv, 4, 76–106):

"POLIXENES. Shepherdess,
A fair one are you, well you fit our ages
With flowers of winter.
PERDITA. Sir, the year growing ancient,
Not yet on summer's death, nor on the birth
Of trembling winter, the fairest flowers o' the season
Are our carnation and streaked gillyvors,
Which some call nature's bastards: of that kind
Our rustic garden's barren; and I care not
To get slips of them.
POLIXENES. Wherefore, gentle maiden,
Do you neglect them?
PERDITA. For I have heard it said
There is an art which in their piedness shares
With great creating nature.
POLIXENES. Say there be;
Yet nature is made better by no mean,
But nature makes that mean: so, over that art
Which you say adds to nature, is an art
That nature makes. You see, sweet maid, we marry
A gentler scion to the wildest stock,
And make conceive a bark of baser kind

By bud of nobler race: this is an art
Which does mend nature, change it rather, but
The art itself is nature.
PERDITA. So it is.
POLIXENES. Then make your garden rich in gillyvors,
And do not call them bastards."

Here we have brought out very distinctly the effect of cross-fertilization in flowers, the result of grafting and the development of varieties. Better than that, we have here the recognition of that tendency in organisms to vary that lies at the very root of the development of species. Natural selection, survival of the fittest, were impossible were it not true that "Nature is made better by no mean but Nature makes that mean"; or, as it is more broadly stated a few lines further on, "This is an art which does mend Nature, change it rather, but the art itself is Nature." I consider these very remarkable statements when we reflect on the time in which they were written. Darwin, in 1860, does but unfold the thought. The selection which Shakespeare notes as practiced by gardeners, and a similar selection seen in the world of domestic animals, gave Darwin his cue of natural selection. The beauty of Darwin's thesis lies in the fact that the process is natural, and such is Shakespeare's dictum. Later on, lines 112–128, Perdita brings out another remarkable observation that has only lately been confirmed by the conclusions of science:

". . . Now my fairest friend,
I would I had some flowers o' the spring that might
Become your time of day; and yours; and yours;
That wear upon your virgin branches yet
Your maidenheads growing: O Proserpina,
For the flowers now, that frighted thou let'st fall
From Dis's wagon! daffodils,
That come before the swallow dares, and take
The winds of March with beauty; violets dim,
But sweeter than the lids of Juno's eyes
Or Cytherea's breath; pale primroses,
That die unmarried, ere they can behold
Bright Phœbus in his strength—a malady
Most incident to maids; bold oxlips and
The crown imperial; lilies of all kinds;
The flower-de-luce being one!"

Primroses are dimorphic—i. e., on the same species we find flowers of different sorts. These are complete, but in any particular flower the essential organs fail of adaptation to each other—the style in one too long, in another too short, to receive pollen from the stamens of its own flower. For fertilization such flowers are absolutely dependent upon the assistance brought by insect visitors. Perdita's primrose is *Primula veris*, the early primrose, "that takes the winds of March with beauty," and dies ere it beholds "bright Phœbus in his strength," and it is precisely this species that forms the basis of one of Darwin's earliest and most fruitful studies in the cross-fertilization of flowers. The styles in one form of the early primrose are three times as long as in the other, the stigmas differ, and the coadaptation of the parts of the different flowers extends even to the grains of pollen. Such flowers in the absence of insects are entirely unproductive. Insects are rare so early in the year, and accordingly many of the primroses die, as Perdita says, "unmarried."

Of course, it is not pretended that Shakespeare knew anything of this; but that he should have discovered the fact that the early primrose bears little or no seed, and that he should have been impressed by the truth that this is due to lack of fertilization, is wonderful. This circumstance might well lead to the suspicion that the poet was a gardener.

We must not forget to notice, too, in this connection, that carnations—i. e., pinks—are remarkable for the great number of their varieties. We have, if I may so say, pinks of every color, from crimson to white, even brown it is said. This was true in Shakespeare's time, if one may trust Gerarde again; he says, "A great and large volume would not suffice to write of every one at large considering how infinite they are, and how every year the climate and country bringeth forth new sorts and such as have not heretofore been written of."

Another passage in which the poet has instinctively hit upon a scientific truth is found in Sonnet IV, the last ten lines. The beauty of the passage as a whole is so remarkable that the delicate touches in particular lines are apt to be overlooked:

> "For never-resting time leads summer on
> To hideous winter and confounds him there;
> Sap checked with frost and lusty leaves quite gone,
> Beauty o'ersnowed and bareness everywhere:
> Then, were not summer's distillation left,
> A liquid prisoner pent in walls of glass.
> Beauty's effect with beauty were bereft,
>   Nor it nor remembrance what it was:
> But flowers distilled though they with winter meet,
>   Lose but their show; their substance still lives sweet."

No botanist can read the line "A liquid prisoner pent in walls of glass" and not recognize the exact portrayal of the living vegetable cell. The living protoplasm is a liquid prisoner sure enough, hemmed in by walls transparent. There could be no more striking image. And when in herb and tree, in every living plant, the summer's work is ended and hideous winter falls, the new cells, summer's distillation left, do in all perennials actually survive, lest of the effect of beauty, beauty be bereft. There is no more marvelous picture in all the vegetal world than that of a great tree with all its myriad cells, in summer so filled with the rush of life's activity and change that we might hear its music, in autumn sinking to quiescence, and the winter's silent chill where liquid prisoners sleep 'neath walls of glass. The poet did not understand it; he simply prophesied better than he knew. He makes us think of Goethe, of Lucretius. These men made happy guesses. Lucretius especially surprises us by his views of the constitution of matter—unverified, so far as we can know. Goethe lived in the age of science and went on laboriously to verify his surmises. The only natural science which Shakespeare knew was gardening—if that may be called a science. His Sonnets are supposed to have been written about 1590, and the first scientific glimpse of the "prisoner pent in walls of glass" came about 1670, through the lenses of Nehemiah Grew, a Puritan physicist and botanist.

I am aware that it is said by some that in a critique like this we are apt to read much into the writings of our author. The quotations I have submitted show, it seems to me, that this is unnecessary in the present case at least. The words are generally unequivocal. Of course, the language is poetical, metaphoric, but the metaphor has reference to something else; the description is not the metaphor. But, in fact, ought we to expect in Shakespeare very exact or complete description? His whole art lies in the power of suggestion. The deep impressions a man of genius makes upon our minds lie often, if not always, in what he does not say. A word or two and the vision rises, whether in Nature or in life, a passion or a landscape. Take the broken phrases of Ophelia depicting her broken heart, her "no more but so"; or the picture of the winter woods in Sonnet LXXIII:

"That time of year thou mayst in me behold
When yellow leaves or none or few do hang
Upon those boughs which shake against the cold,
Bare ruined choirs where late the sweet birds sang."

Does any one pretend that we are reading into the lines when we appreciate the marvelous sorrow of the one picture or the exquisite truthfulness and splendor of the other?

Shakespeare's natural eye was clear indeed, but none the less he seems to have seen everything with the eye of his mind. Faraday so saw the world of force, Newton of mathematical law, and Tyndall's scientific use of the imagination lies in the same direction.

And so the man of science and the poet have much in common. Both use the natural world, and the imagination is for each an instrument of effort. The poet's generalization is a splendid vision in a world ideal, suggested, no doubt, by what is actual and liable here and there to coincide with truth; the generalization of the scientific man is likewise a vision, but it rests upon the actual, upon the ascertained fact at the greatest number of points possible, and disappoints us only that it is not everywhere coincident. The poet dreams of Atlantis, the lost continents, the islands of the blest, and builds us pictures that vanish with his song; the man of science too beholds the continents rise; scene after scene he likewise makes to pass across our startled vision; but his are history, his tapestries are wrought in the loom of time.

The poet writes the book of Genesis, with the herbs bringing forth fruit after their kind; the man of science figures fossil leaves and cones and fruit. Only at the last do poetry and science possibly again agree:

> " The cloud-capped towers, the gorgeous palaces,
> The solemn temples, the great globe itself—
> Yea, all which it inherit shall dissolve,
> And like this insubstantial pageant faded, leave not a rack behind!"

And when the man of science gathers all his data, and collates fact with fact, and builds the superstructure of his vision, with him, too, all things fade and vanish in the infinity of the future.

AMERICAN INDUSTRIAL EXPOSITIONS—THEIR PURPOSES AND BENEFITS.

By MARCUS BENJAMIN, Ph. D.

INDUSTRIAL expositions are a natural development of the fairs of the middle ages. The latter are believed to have originated in the religious gatherings which afforded an opportunity for the sale of wares to large numbers of people. Such fairs still persist in northern Europe, and the best known of them is probably that held three times a year in Leipsic, to which, it is said, "some twenty-five or thirty thousand foreign merchants" are still attracted each year.

In course of time international exhibitions at which specimens of the arts and industries of the great nations of the world were contrasted came into vogue. These began with the International Exhibition held in London in 1851, and of them three have been held in the United States, as follows: The first in New York, in 1853; the second in Philadelphia, in 1876; and the third in Chicago, in 1893. The great magnitude of such expositions has led in recent years to their specialization or subdivision into expositions at which only a specialty was presented. Notable among such have been the following, which were for the most part international: Of articles connected with the leather industry, held in Berlin, in 1877; of all kinds of paper and pasteboard, held in Berlin, in 1878; of fisheries, held in Berlin, in 1880; of electricity, held in Paris, in 1881; of geography, held in Venice, in 1881; of cotton, held in Atlanta, Georgia, in 1881; of early data in American history, held in Madrid, in 1881; of fisheries, held in London, in 1883; of historical matters pertaining to Columbus and the discovery of America, held in Madrid, in 1892; and of hygiene, including chemical, pharmaceutical, and sanitary objects, held in Naples, in 1894.

Similarly there has been a development in the United States from local fairs, such as those of the various mechanics' institutes, typical of which is the one held annually since 1828 in New York city under the auspices of the American Institute, into interstate expositions. Of these, since 1880, the following have been held: Cincinnati Industrial Exposition, Cincinnati, Ohio, September 30 to October 4, 1883; Southern Exposition, Louisville, Kentucky, August 16 to October 25, 1883; World's Industrial and Cotton Centennial Exposition, New Orleans, Louisiana, December 16, 1883, to June 30, 1884; Central Exposition of the Ohio Valley and Central States, Cincinnati, Ohio, July 4 to October 7, 1888; California Midwinter Fair, San Francisco, California, January 1 to July 4, 1894; Cotton States and Industrial Exposition, Atlanta, Georgia, September 18 to December 31, 1895; Tennessee Centennial Exposition, Nashville, Tennessee, May 1 to October 31, 1897; and Trans-Mississippi International Exposition, Omaha, Nebraska, June 1 to November 1, 1898.

Of the foregoing, the more important were those held in New Orleans, in 1884; in San Francisco, in 1894; in Atlanta, in 1895; in Nashville, in 1897, and in Omaha, in 1898; especially so from the fact that all of these received recognition by the Government; and, with the exception of that held in San Francisco, liberal appropriations were made for their support by Congress. Moreover, at each of them, excepting again that held in San Francisco, a special Government building was erected in which the national Government made exhibits of the workings of the several executive departments, together with the Smithsonian Institution and its dependencies and the Fish Commission.

The first named, that of New Orleans, was held as a celebration of the centenary of the cotton industry in the United States. The first record of cotton as a factor in the foreign trade of this country appeared in the shipment in 1784 of six bags, amounting to about one bale, from Charleston, South Carolina. Audubon Park was the site on which the buildings were erected.

The exposition held in San Francisco, in 1894, had for its purpose the affording of an opportunity to foreign exhibitors at the World's Fair to further display their goods in the United States, and in consequence a great number of exhibits were shipped direct from Chicago to the Pacific coast. The exposition was located in Golden Gate Park.

The Atlanta Exposition had its inception in a belief that the agricultural, mineral, and manufacturing resources of the South were not adequately represented in Chicago in 1893. It was believed that a better exhibit of the products of the Southland would tend to foster greater trade relations between that section of our country and other parts of the United States, as well as with foreign countries, especially those to the south, such as Mexico. The Cotton States Exposition was held in Piedmont Park.

The exposition in Nashville was designed primarily to celebrate the one hundredth anniversary of the admission of Tennessee into the Federal Union. Recognizing the commercial and educational advantages to be derived from such a demonstration, it was deemed wise to characterize the celebration as an exhibit of "the matchless resources of Tennessee, and at the same time to lead to their greater development." The old West Side Park was chosen as the site of the "Centennial City."

The exposition held last year in Omaha had for its purposes to do for the Trans-Mississippi States what the more local exhibitions had done for Atlanta and Nashville. It was claimed that it would for the "first time fully illustrate the wealth-producing power and the extent of productive industries of the Greater West," and it did. The exposition grounds were included within what was called the Kountze tract and the old fair grounds.

Each of these expositions has been projected for distinct commercial reasons. They have had for their immediate purposes the presentation of the products of the region in which they were located to their neighbors, to the nation, and to the world. In this sense they have been simply the offspring of the fairs of the middle ages, differing from them only in that the feature of sale has been largely eliminated. That they have been successful in accomplishing the results desired is beyond doubt; indeed, the expositions in Nashville and Omaha were even financial successes. But they have done more than this; they have accomplished a world of good in the way of education.

Let us consider some of these benefits. Beginning with the grounds, these have been given over to the charge of some competent landscape architect under whose skillful supervision the desert has been made to blossom like a rose. The sand hills of San Francisco became the beautiful "Palm City," which since the close of the exposition has become one of the most attractive spots in the Golden Gate Park. At Nashville the landscape effects were claimed by many to excel in beauty those of the World's Fair in Chicago. "Evergreens, vines, and shrubs are everywhere, and three lakes break this vista of green," was the opinion of one visitor. Besides the general architectural effect of the buildings, which can not but impress those who are so fortunate as to visit these expositions, there is a special value in the reproductions of historical buildings. At Atlanta the Massachusetts Building was a representation of the Craigie House, the headquarters of Washington when in Cambridge at the beginning of the Revolution, and later the home of the poet Longfellow. It was a fortunate inspiration of the late Dr. G. Brown Goode that led to its presentation by the State of Massachusetts to the local Society of the Daughters of the American Revolution. The architectural feature of the Nashville Exposition was the replica of the Athenian Parthenon in all its artistic beauty. Every detail was true to the original in design and coloring. It was the chief glory of the centennial, and as it was a permanent structure it will long remain to the "Athens of the South" a memorial of its exposition. Of less conspicuous interest were the reproductions of the Rialto of Venice and the Alamo of San Antonio.

The only architectural feature of historic character announced for Omaha was that "the Arkansas Building will be a reproduction of the mansion of General Albert Pike in 1843." The long oval waterway around which the buildings were grouped afforded, however, excellent opportunity for studying the architecture of the buildings, which, it was claimed with much justice, approached those of the never-to-be-forgotten "White City" in their beauty of design.

From the exterior to the interior is a natural method of progression. Let us therefore pass to a brief consideration of the educational features that are to be derived from an examination, no matter how cursory, of the displays that are to be seen within the buildings. First of all, and indeed frequently the most important, is the exhibit made by the national Government. In the special building devoted to that purpose are shown the exhibits of the several executive departments, including also that of the Smithsonian Institution and its dependencies, and the Fish Commission. As a result of the years of accumulated experience there has been in each of the expositions previously mentioned, except that in San Francisco, a distinct improvement in the installation of the exhibits in the Government Building, until it was recognized in Atlanta that the display was superior to that in Chicago, and in Nashville "the best exhibit ever made" was the verdict of those who had seen the successive expositions previous to that in Omaha. Therefore the telling of a story by means of objects in the best manner possible is the result sought for and attained most perfectly by those who installed the Government exhibits.

It is, of course, understood that the purpose of the Government exhibit is to familiarize the public with the methods of carrying on the functions of the different departments. Thus, in the post-office exhibit there is shown the entire sequence of postage stamps, both of the United States and foreign countries, the various kinds of mail bags, figures of the mail carriers in their different uniforms, and finally models or pictures of the methods of transportation. The Treasury Department shows the working of the mint by the striking of commemorative medals, while a full series of the existing medals and coins of the country are displayed in cases on the wall. The functions of the Department of the Interior are shown by exhibits of a series of models of some important invention, as, for instance, a sequence showing the development of the sewing machine. In this way—for of course the blanks and other documents are shown—the working of the Patent Office is demonstrated; while the Geological Survey, also of the Department of the Interior, presents a series of minerals, showing the economical wealth of the country, together with its maps and reports, results of work accomplished. Everything can not be shown, but a most excellent idea of what each department does can be had from a study of the exhibits of the Government.

Next in importance to the Government Building is the one devoted to commerce, and here are usually to be found the weak points of our American expositions. In lieu of a series of exhibits showing the progress in a given industry or trade, we find too frequently a collection of nondescript articles without much if any relationship to each other. This is due primarily to a lack of proper organization in soliciting exhibits, and also because the awards or medals of the jurors are so often of no relative value. The second condition is an outcome of the first. To be more specific, in Nashville there were no exhibits from any one of the larger and well-known silver firms, and yet American silverware has a recognized status as one of the most successful of our American art industries. Cut glassware is another branch in which our artisans or art workmen have achieved splendid results, and still there were no exhibits from art glassmakers in Nashville. Certain varieties of art pottery and art glassware, such as the Rookwood pottery and the Tiffany glass, are seldom seen at these smaller expositions. In consequence the juror makes an award to the best article of its kind on exhibition, which may be but a third-rate article compared with others; still it is the best shown in the exposition, and therefore worthy of recognition. Another unfortunate feature must be mentioned at this point. It is the decorative feature. At the last World's Fair held in Paris there was a colossal figure of George Washington in chocolate exhibited by an American manufacturer of that article. While it might be considered as a laudable attempt to make known to the French nation the features of the "Father of his Country," and from that point of view worthy of recognition, still it was no evidence of the superiority of the chocolate, and therefore could not be considered in connection with the giving of an award. This condition of affairs prevails at every exposition, and too frequently an exhibit of a meritorious article is made in such a modest manner that its claims are overshadowed by the pretentious display of something quite inferior.

Two conditions thus present themselves—namely, the lack of proper exhibits and the improper presentation of certain exhibits. The first condition may be overcome by a more perfect canvass of the industries of the country. In nearly every one of these there is a national organization, and it should be the duty of that body to consider the matter. By the appointment of committees and working among the representatives of the industry, either a good exhibit from the leading firms could be secured, or else a collective exhibit of the best from many firms could be obtained. Typical of the last named was the exhibit made by the potters of the country at the World's Fair in Chicago. By the adoption of such a method of displaying the products of manufacturers the possibility of the second condition would be entirely eliminated.

After all, the value of these expositions is chiefly educational, and surely no more perfect way of educating the visitor or sightseer could be found than by placing before him a historical series of products, beginning with the one made first in point of time, continuing with better specimens, showing the improvements that have resulted from increased experience and knowledge, and culminating with the finest product now made. The contrast between the first and the last would be indeed most striking.

It must not be thought from the foregoing remarks that these interstate expositions have been lacking in the presentation of the products of their own home industries. Far from it. In San Francisco, in Atlanta, in Nashville, and in Omaha the local manufacturers did themselves great credit by the admirable way in which their goods were shown, but it was just in this particular feature that the weak point indicated previously made itself most conspicuous. A local silversmith could hardly be expected to compete with the more famous manufacturers in the same line in larger cities, and yet in the absence of an exhibit by the better known firm an award would naturally be given to the smaller manufacturer, thus creating a false impression to the world at large.

It must not be assumed that the educational value of the exhibits in the Commerce Building is without commendation. Next to making a thing, the seeing of it is most important, and surely no one can pass along the aisles of any exposition without noticing much that is new or unusual, no matter what his previous experience may have been. It is in this connection that the foreign section is frequently most instructive. Warm furs from Russia and the north, rich fabrics and strange metal ware from the Orient, rare porcelains from Copenhagen, and brilliant glassware from Bohemia and Hungary, tell the story with striking vividness of the special products of the Old-World nations.

As has been shown, the finished products of manufacturers are those that are housed in the building devoted to commerce and manufacturing, but the raw materials require a building or two for themselves. That in which the products of the earth are exhibited is usually designated the "Minerals and Forestry Building." This requires but brief mention, and has its chief interest for the expert. Geological specimens, including paleontological and lithological exhibits, show the age and character of the soil, while the rocks further indicate the possibilities of the territory, for they show the geological horizon. In natural order are shown the minerals of the country. At Atlanta and Nashville the richness of the mineral wealth of the Southern States was fully demonstrated. Not only ores such as those of iron and manganese, but the combustible minerals, as coal, lignite, and petroleum, were exhibited. More striking, perhaps, are the great numbers of economic minerals that these expositions show. The materials—phosphate rock, sulphur, and nitrates—used in making artificial fertilizers; the marbles; the pigment-yielding minerals, including ochres, umber, and barite; the clays, with their products of earthenware and pottery, bricks, and tiles; and even mineral waters are among the different minerals to be seen. It is from such exhibits that something of an idea is obtained of the enormous wealth that is contained in the earth, waiting only to be excavated and fashioned into articles of beauty and utility. While such exhibits are frequently to be seen in museums, still the average mind is more impressed by the casual examination of these things in expositions, and one's pride of home increased by the rich stores of mineral wealth attractively installed. It is customary also to show models of the machinery used in mining, and even books, maps, and drawings are not uncommonly seen.

A similar arrangement is followed in regard to the forest products. Logs and sections of trees, as well as samples of wood and timber of all kinds, are shown. Then come the finished products—boards, shingle, and moldings—and finally the manufactured articles, such as pails, tubs, and then furniture. Barks, as for tanning or dyeing, seeds and gums, and the wood pulp for paper are on exhibition. Among the miscellaneous products deserving mention are fibers, as used in basket-making or cane work.

Forestry as a science is made the basis of a series of exhibits. These include timber culture, tools used, and methods employed in planting and caring for trees. And finally lumbering as a science finds a place in the scheme followed in this department. This includes the tools used in lumbering and the methods employed, as well as exhibits illustrating the tan-bark industry, the turpentine industry, and the charcoal industry. So it happens that there is much that can be learned by the student who will devote a little time to the analysis of the exhibits in the building devoted to the products of the mines and the forest.

A visit to the Agricultural Building reveals to the interested observer those products of the soil that are for the most part the result of cultivation, and so we find exhibits of cereals—wheat, oats, barley, and the like—and then their immediate products: bread, pastes such as macaroni, and starches. The sugar-yielding plants, together with honey and the manufactured product, as candy and other confections, come next in order. The root crops, such as potatoes or beets, and the vegetables, are of much importance. Preserved meats and food preparations, dairy products, spices, tea, and tobacco are among the articles on exhibition. Then come the plants yielding fibers, as cotton and the like; but we hasten on to make mention of the exhibits of implements used in agriculture and its special subdivisions, such as horticulture, viticulture, floriculture, and arboriculture. Who will gainsay the fact that the farmer can not do otherwise than learn much from a visit to the home of the products of the soil? It it also customary to include a live-stock exhibition during some period of the exposition.

Mention has been made of the building devoted to the finished products of manufactures and of the buildings in which the crude materials are displayed. Besides these there are usually several buildings devoted to the exhibition of the means by which the original substances, whether from the mine, forest, or farm, are made up into the commercial product for the merchant. One of these is called the "Transportation Building," and in it we find the various means by which the raw materials are conveyed to the factory. From the lower forms of transportation of which man is the motive power, such as the wheelbarrow, upward through the various forms of vehicles of which the power comes from horses and other animals, until as the topmost member of the series is shown the magnificently equipped train of railway cars, provided with all the conveniences that modern luxury can devise. If the visitor is not content with land locomotion, more than likely he can find an exhibit in which transportation on water is possible, as by means of a naphtha or steam launch.

Machinery is the active means by which the immediate transposition of the crude material into the finished article is accomplished. And in a building where the ceaseless belt moves with the rapidly revolving pulley may be seen the many forms of machinery which the active brain of the ingenious mechanic has devised to cheapen labor and increase production. The change of the cotton fiber into cloth, or the passage of the silken thread into the finished handkerchief; the revolving cylinder on which the virgin sheet of white paper becomes the printed purveyor of news; or the many and varied appliances by which the piece of leather is fashioned into a covering for the foot; or again the means by which the strip of steel is made into a pin or needle, are among the interesting things that may be seen in Machinery Hall.

Conspicuous among the many interesting wonders of science that were shown at the Centennial, in 1876, were the few, insignificant, blue, flickering, and unstable lights that ushered into existence a new era in the history of electricity. In Atlanta, in Nashville, and in Omaha a building was necessary to hold the appliances and products of the latest of our sciences. Telephones no longer impress us by their newness, and the appliances of electricity to heating and lighting are now household necessities. To those who treasured the memory of the beauty of the lighted Court of Honor at the White City in Chicago there was given a greater joy when the entire grounds of the beautiful Centennial City in Nashville were illuminated with more than seventeen thousand incandescent lamps. Daylight had faded into darkness only to emerge into an electric day of brilliancy unsurpassed. Thus was told the story of the progress of the science which as a result of the studies of Franklin, Henry, Morse, and Graham Bell may well be regarded as the American science.

A parting word must be given to the amusement features. How the Streets of Cairo, now so hackneyed, linger in one's memory! The Enchanted Swing was one of the novel features of the Midwinter Fair in San Francisco, and of weird interest was the Night and Morning in Nashville. The Mexican and Japanese villages were excellent features in Atlanta, and so was the Chinese village in Nashville, although the "Old Plantation" was more popular. Panoramas such as that of the Battle of Gettysburg, or pyrotechnic spectacular shows such as The Storming of Wei-Hai-Wei, are of value. The musical features must not be forgotten, even if popular fancy leans toward Dixie, for the occasional "Gems from the Operas" help to leaven the mass. At Nashville the military drills by the national and State troops were of considerable interest, and much had been hoped for in Omaha in this respect, but the war prevented.

In this analysis, incomplete, it is true, of these American interstate expositions something has been shown of their design and more of their benefits. They have had for their purpose the exhibition of the materials, processes, and products of manufacture, but their ultimate benefit has been that of education. To the thoughtful an opportunity has been afforded of following the crude material through the processes of manufacture until the finished product has been exhibited. The variety of crude materials was shown him, the different processes were contrasted, and finally the completed article was exhibited which possessed this merit or that advantage according to the process followed. For the mere pleasure-seeker there were the delights of attractive surroundings, the beauty of the exhibits, and the delights of music or other entertainments. Indeed, all the influences are for good.

Let it then be the effort of every one, whether official, exhibitor, or visitor, to use his influence to improve and elevate these expositions so that only the most desirable localities shall be chosen in which to hold them, and let the selection of exhibits be made so as to include the most worthy; for then, and only then, will the visitor derive the greatest benefit.

And so from time to time and in various places we shall have these interstate expositions, which will show to the world the advancement made in the development of the resources of our great country.

BOOKWORMS IN FACT AND FANCY.

By WILLARD AUSTEN.

> "What is a bookworm? Tell me if you can;
> I merely mean the insect, not the man—
> A reptile whom a wit like Hood might dub
> A grub that grubs in Grub Street for its grub."
>
> Robert Rockliff.

SO much mystery has gathered around the term bookworm, so much imagery has been employed in depicting the appearance and devastations of this mythical creature, that many have been prepared to accept almost anything, no matter how fabulous, that might be said about this unknown enemy of literature. Reaction against these weird and fantastical accounts is indicated by the question, not infrequently asked, "Are there such things as bookworms?" Few are aware that in this creature we encounter another case of masquerading, that these "destroyers of the Muses" are common enough pests playing other rôles than those in which they are familiarly known. Some of them are met with daily in the house and elsewhere, and arouse no unusual interest, while the world goes on wondering what a bookworm is like.

Insects injurious to books and bindings are not a new subject. The Greeks and Romans observed and wrote about them, but notwithstanding, their knowledge of zoölogy, comparatively speaking, was so meager, they do not seem to have felt any of the mystery or wonderment about these creatures which we have felt. The terms *blatta, tinea, silphe*, are frequently met with in the works of classical writers, and, while we can not be sure of the particular species they intended to allude to by these terms, we do in many instances know from the context that the creatures known to them had like characteristics with those known to us, and that they were given to literary depredations as are their descendants.

The earliest allusion to a book-destroying worm which has come down to us from classical lore was rescued from oblivion by the lad Salmasius in 1606, when he discovered the manuscripts of the anthology of Cephalas in the library of the Counts Palatine at Heidelberg. Among the fragments in this collection is one attributed to Evenus, the sophist-poet of Paros, who wrote about 450 B. C., in which the " foul destroyer " is thus berated:

" O worst enemy of the Muses, devourer of the pages of books,
Foul destroyer that lurkest in a hole, ever feeding on what thou hadst stolen from learning,
Tell me, black-colored bookworm, why dost thou lie in ambush to injure the sacred decrees while fashioning thy envious image ? "

Aristotle, in his History of Animals, mentioned the " little scorpionlike creature found in books "; a characterization which obtains to-day for the little creature which Leunis calls the "*Bücherscorpion.*" Horace addresses his finished book, to which he imputes an unbecoming haste to be displayed on the booksellers' stalls, thus: " When thumbed by the hands of the vulgar, you begin to grow dirty, then you will in silence feed the groveling bookworm." Ovid, in his exile at Tomi, likens the " external remorse of its cares " which his heart feels to the gnawing of the *tinea.*

Considering the fact that Pliny is said to have comprised in his Natural History all the knowledge of the natural sciences then known, it is a little surprising that he had not more to say regarding book insects. Here and there in his writings, however, he speaks of worms in connection with books and papers in the same casual way as other classical writers, causing you to feel that he was conversant with their destructive tendencies. The epigrammatist Martial in the first century, and Lucian in the second, both use the term bookworm; Martial, in much the same way as did Horace, warning his book of the fate awaiting it; Lucian, in his well-known dialogue, The Dream; or, The Cock, as a symbol of the condition to which miserly man may descend.

Sufficient has been said to show the attitude of the ancients toward these little pests, that had no more regard for their precious thoughts than for the utterances of modern "statesmen," whose speeches are "read by title and ordered printed."

Crossing the cloistered period of the ages called dark, when books were so few and so constantly used by the jolly monks that these little creatures must have had a difficult time getting a living unobserved, we come down to the sixteenth century, by which time books had begun to multiply and worms to propagate. In the last quarter of this century we find Pierre Petit, who is numbered among the celebrated pleiade of Latin verse writers along with Rapin, Commire, and others, addressing these "impudent creatures" in a thirty-four-line Latin poem titled In Blattam.

A curious and interesting characterization of some species of book insects has come to us in the writings of Christian Mentzel, the German naturalist and philologist, who lived in the seventeenth century. When one reads that he heard the bookworm crow like a cock, and said, "I knew not whether some local fowl was clamoring or whether there was but a beating in my ears," one can not help wondering if there was not something defective in his ear drums; but further on he says, "I perceived, in the paper whereon I was writing, a little insect that ceased not to carol like very chanticleer, until taking a magnifying glass I assiduously observed him." From this one concludes that if the fault were not with his hearing, by which some well-known sounds made by book insects seemed to him like the crowing of a cock, an altogether different cock from the kind we know must have lived in his day.

The earliest observations on the subject possessing any scientific value were made by Robert Hooke in his Micrographia, published in London in 1665. In many respects this work was a curious medley of facts and fancy. The registers of the Royal Society, of which he was a member, testify to the eagerness with which Hooke hurried from one inquiry to another with "brilliant but inconclusive results." Among the many objects which engaged his attention was an insect which he described in a chapter entitled Of the Small Silver-colour'd Bookworm. His description shows it to have been the "fish-tail," by naturalists called *Lepisma,* well known as one of the pests that not infrequently is found in the library as well as other parts of the house.

Many interesting instances of the discovery of bookworms are found in the literature on the subject, showing the keen interest felt in the search for specimens of the "destroyer," many of them revealing the fact that some unique and curious creature which stands alone in its taste for literary food was sought. Mr. Blades reported in 1858 that he found specimens in some black-letter fragments at the Bodleian Library, that were recognized by the librarian, Dr. Bandinel, who crushed them with his thumb, saying, as he wiped his thumb nail on his coat sleeve, "O yes, they have black heads sometimes." The librarian of Hereford Cathedral, the Rev. F. S. Havergal, contributes his observations, covering a period of eighteen years, during which time he reports that he found two distinct species. From his description, however, it appears that he failed to recognize that the two were the larva and imago of the same species. Many cases of the finding of bookworms reported in England and America are not accompanied with sufficient data to determine just what they were. These contribute to the general impression that many have sought but few have found what were thought to be "genuine bookworms," while on every hand are those creatures which under the right conditions become book destroyers.

Research among the literature concerning library pests reveals the fact that no less than eleven different groups have members that are directly or indirectly accused of injuring books and bindings. The number of species in each group ranges from one to eleven, making a total of over thirty different species. In addition to these there are others against which the evidence is at best only circumstantial. It is not necessary to say that none of these bear any resemblance in any period of their existence to worms, and that the term bookworms is a misnomer. The word has become so firmly fixed in literature, both in its figurative and literal sense, that its misuse will no doubt continue.

The larger number of these are included in the class *Hexapoda*, or insects. Two species belong to the class *Arachnida*, which embraces the scorpions, spiders, mites, etc. One of these, *Chelifer cancroides*, known as the "book scorpion," although not a true scorpion, belongs to the order *Pseudoscorpiones*, and is probably what Aristotle had in mind when speaking of the "little scorpionlike insects found in books." The other species is known as *Cheyletus eruditus*, of the order *Acarina*, or "cheese mites." These two are known to be carnivorous in their habits, and there is some question as to whether they haunt books for the purpose of feeding on them or on other creatures to be found there.

Of those in the class *Hexapoda*, which comprises all the other known book pests, there can be no question as regards their destructiveness. Many are known about the house by the name of the article they are most frequently found in, and unless driven by a lack of those things more to their liking, they do not invade the literary sanctum. Some are so cosmopolitan in their tastes that they seem to take whatever is most convenient, whether it be books or boots, pepper or poison.

As has been said, the earliest observation of value was made by Hooke on *Lepisma*, commonly known as "fish moth" or "silver fish," from its resemblance, in shape and coating, to a fish; also as "bristle tail," from its caudal appendages. They are found in closets, cupboards, and clothes baskets. Opinions have differed as to its destructiveness to books, but the weight of evidence is against the insect. It seeks the paste and sizing used about books, and this leads it to attack bindings and labels. There is a theory that paste made from pure starch is not to their liking, but this is not substantiated by observation.

Termites or "white ants," another misnomer, since they are not true ants, are also well-known ravagers whose deeds of destruction assume a serious aspect, especially in the tropics. "Humboldt," according to Shimer, "informs us that in all equinoctial America, where the white ants abound, it is infinitely rare to find papers or books that go back fifty or sixty years." Their destruction to timber has been the cause of serious accidents, at one time so weakening the supports of a dwelling that a whole dinner party was precipitated from the third floor to the basement. These pests belong to the order *Isoptera*. The American species is known as *Termes flavipes*, and several well-authenticated cases of their having done serious injury to books and bindings in this country are recorded. As the chief sustenance of these insects seems to be dead wood, it may be that the increased use of wood in paper will make modern books, which bookworms are said to scorn, more tempting than ever to them.

By opening quickly some old book which has lain long unused, one may see tiny pale creatures with knowing black eyes scurrying across the pages. These insects are known as "book lice," or by the Germans as "*Staublaus*" (dust louse). Entomologists have given them the high-sounding name *Atropos divinatoria*. They belong to the family *Psocidæ*, of the order *Corrodentia*. Some writers, beginning with William Derham, in 1701, are of the opinion that this delicate little creature makes a noise like unto that of the coleopterous insect called "death-watch." These little fellows are said to have stout jaws with which they do damage to books, dried plants, etc., "nibbling away the leaves and covers of the former."

Of all the insects that injure books perhaps the best known are the cockroaches, scientifically called *Blattidæ*, of which there are five species whose bookish habits are unquestioned. Many instances of serious damage done by them to the bindings of books are on record, the most important, perhaps, being that of the Natural History Museum Reports, at Albany, where Mr. J. A. Lintner found a hundred volumes or more so badly damaged by roaches that they could not be moved without coming to pieces. The United States Senate Reports, bound in cloth and leather, some fresh and new, have been badly damaged at Washington, in the efforts of these pests to get at the paste with which the covers were fastened to the volumes. The species known to commit these depredations are the "Croton bug" (*Blatta germanica*), smaller than the others, but considered by some writers as the worst pests of the family; a little larger species, called *Periplaneta orientalis;* and a large species, known as *Periplaneta americana*, or *Kakerlac.* Against two other species, *Blatta australasiæ* and *Blatta gigantea*, there is not so much evidence.

Among the moths, or millers, order *Lepidoptera*, are found several species which injure books, the best known being the *Aglossa pinguinalis*, commonly called "grease moth." The larva of this species is at first a pale, flesh-colored grub, but as it matures it becomes quite black. It injures bindings by constructing long "silken tubes," in which it remains until full fed. Sometimes they spin a web between the volumes, "gnawing small portions of the paper with which to form their cocoons." This species belongs to the family *Pyralididæ.* Of the family *Œcophoridæ* two species are known to injure books: *Acompsia pseudospretella*, and an undetermined species of *Depressaria.* Under the name *Œcophora*, William Blades describes the ravages of the former on two leaves of a "Caxton," and accompanies his remarks with a photographic illustration of the damaged leaves, from which it is at once seen how irregular is the gnawing of this species. The newspaper account of the finding of bookworms in the Lenox Library not long ago classed the larvæ found with this species.

The largest number of book-destroying insects are found among the beetles, of the order *Coleoptera.* To this group belong the "book borers." The species thus far considered have been more or less dilettants in literature. The beetles, however, seem possessed with a true spirit of investigation, and when they undertake a piece of work in a serious fashion they go to the bottom of it, sticking close to the line laid down. This characteristic distinguishes these insects from all others, and makes it comparatively easy to determine when they have been at work in a worm-eaten volume. No less than sixteen different species of this order have been either detected in this work, or such strong circumstantial evidence has been found against them, that there is little doubt as to their guilt. Some insects seem to destroy books for the sheer want of something better to do; some do so in seeking the paste and sizing used in and about the books; others because the leather bindings are desirable material in which to undergo transformation; and, again, others haunt book shelves and books in search of prey in the form of living creatures. But among the beetles are found tiny little grubs that seem to have a genuine intent to destroy; that set out deliberately to wreak vengeance on man's record of his thoughts, deeds, and discoveries, and, as if knowing the means which man uses to destroy, have sought to imitate him in the effects produced. As a result we find books filled with small, round, shotlike holes strongly suggesting the results which might follow from the use of the family Bible by the restless boy as a target for his first shotgun.

The book-destroying beetles are all grouped under three families: *Dermestidæ*, *Scolytidæ*, and *Ptinidæ*. The *Dermestidæ* include the "flower beetles" and the well-known "carpet bug." The species of which there can be no doubt as to its disposition to pierce book bindings is *Anthrenus varius*, which Glover says "is a very pretty insect when examined under a magnifying glass, being beautifully marbled or variegated with black and gray." Another member of this family, against which there is less evidence, is *Dermestes chinensis*, so named by Dr. L'Herminier, of Guadeloupe, who reported a loss of nearly four hundred volumes from its ravages. Erichson believes this to have been the well-known *Anobium paniceum*. *Dermestes lardarius* and *Attagenus pellio* are others of this family mentioned in the same category.

The family *Ptinidæ* includes two groups, *Anobium* and *Ptinus*, the first being generally known as the "death-watch," from the peculiar sound, like the tick of a watch, which is produced by striking against a hard substance with their tiny jaws. Superstitious persons have long considered this noise an omen of death, hence the name. Instead of an ill omen, this noise proves itself to be a love-call between the sexes, and may be imitated accurately enough to elicit a response. One of the best known of these beetles is called *Sitodrepa panicea*, generally known in Europe as *Anobium paniceum*. It is a cosmopolitan feeder, having a reputation in several different fields of activity, commercial and scientific as well as literary. To druggists it is known as "the worm," and their stock of ginger, rhubarb, Cayenne pepper, nux vomica, and belladonna root all appear to be equally to its liking, tin foil being no formidable barrier to its persistent search. Leather dealers have suffered from the destruction wrought by this little fellow to such an extent that whole cases of boots and shoes, carriage trimmings, etc., have been ruined. To this species belongs the insect found a few years ago at work in a volume of Dante's Divine Comedy, which had been sent to Cornell University library from Florence. The larvæ are about three to four millimetres in length, of a dirty-white color, head tinged with brown, and black mouth parts, with the abdomen strongly curved. The adult is a small, cylindrical, brown beetle from two to three millimetres in length, with head bent down and wing covers marked with fine punctate striæ.

Professor Poey made extensive observations of an insect in Cuba which had destroyed about four thousand volumes. He called it *Anobium bibliothecarum*, and Schwartz thinks the injury reported by Herminier from Guadeloupe should be attributed to the same species. *Anobium striatum* and *pertinax* have long been known to injure books by their "gnawing and burrowing," not only in and through the bindings, but also entirely through the volumes. *Nicobium hirtum*, a native of southern Europe, where its larvæ have been found doing like injury, is only locally abundant, and for this reason has never been considered a serious library pest. Schwartz says, "In one way or another the insect has found its way to North America, but has always been regarded as a great rarity with us."

The *Ptinus* group embraces *Ptinus fur*, *Ptinus mollis*, *Ptinus brunneus*, and *Ptilinus pectinicornis*, called by Leunis "*Bücherbohrer*." According to Butler, a peculiarity of this genius—that of dissimilarity of shape between the sexes—is well illustrated by the *P. fur*, the male being almost cylindrical, the female inflated or rounded at the sides; so much variation that they might be taken for two different insects. *Ptinus brunneus*, although similar to *P. fur*, is distinguished from it by being wholly of a light-brown color and destitute of whitish bands on the wing covers. Some writers speak of this species as the "book beetle," while *Sitodrepa* is spoken of as the "spice beetle." Dr. Henry Shimer makes the following statement regarding their method of boring: "They usually operate in leather-bound or half-bound volumes by boring galleries along in the leather. . . . They usually bore along quite under the surface of the leather, cutting it almost through; occasionally a small round hole penetrates through the leather to the outer surface."

One of the most famous cases on record of insects boring through books is that reported by M. Peignot, in which he states that twenty-seven folio volumes were pierced through in so straight a line that a cord might be passed through them and all the volumes raised by means of it. Different writers give the credit of this feat to different members of this group, so that the most that can be said is that it was the work of some member of the *Ptinidæ*.

In the family *Scolytidæ* only one species belongs to the book ravagers. It is known as *Hypothemus eruditus*, and was described by Westwood in 1836 as "pitchy black, the head of the same color, entirely concealed from above by the front thorax." It is very minute in size, being about one twentieth of an inch in length. So far as its depredations have been observed it confines its work to the bindings of books, making furrows in all directions much as it does in the sap wood of dead trees. The strong resemblance of its burrowing to the gouging done by an engraver's chisel has given to this family the name of "engraver beetles."

A review of the different families of insects whose habits under favorable conditions lead them to infest books and bindings will show them to be more or less well defined according to their feeding habits. The book scorpions and mite, *Cheyletus eruditus*, which, as we have seen, do not come under the head of insects, are primarily carnivorous, and their presence in books may be due to the fact that they find there animal as well as vegetable food. This is certainly true of the book scorpion, which feeds on mites, book lice, and other small insects. The "fish moths" or "silver fish," the "book lice," and the "cockroaches" can have no other reason for infesting books than their liking for farinaceous substances such as are used in and about the bindings and labels of books. For this reason the damage done by them is largely confined to the exterior or interior of the bindings, and only so much of the book itself is injured as comes in their way in their search for food. The "white ants" feed principally on wood, and in and about books there is more or less wood fiber which would be to the liking of these voracious feeders. The moths and beetles are the burrowers and borers. They seek retired places in which to lay their eggs where the larvæ will be surrounded with food for their growth. The moths and some of the beetles are more given to burrowing in the bindings, keeping close to the outer surface for the purpose, it is thought, of making it easy for the imago to emerge after the change is completed; while others bore straight tunnels often from cover to cover.

A natural conclusion for one who has gone over the literature of book-injuring pests to reach is that the many persons that have been industriously looking for the bookworm, as well as those that have reported the finding of isolated specimens, some dead, some alive, have had in mind the one creature which bored holes in books. The frequent use of the terms "genuine bookworm," "the real bookworm," etc., reveals the fact that the users of these phrases approached the subject with a preconceived idea of the kind of creature they should find to account for the ravages only too apparent on scores of volumes which pass through the hands of booksellers and book keepers. To many the boring beetles are the only creatures which are rightfully called bookworms, and in their search other book pests have not been taken into account.

HYDROPHOBIA IN BAJA CALIFORNIA.

By DANE COOLIDGE.

WHEN, in 1884, Pasteur discovered the true nature and cure of hydrophobia, he dispelled the accumulated superstition of centuries regarding this mysterious and dreaded disease. But in some countries where hydrophobia exists his cure is not yet known, and the old superstitions remain. While collecting mammals near San José del Cabo, in the cape region of Lower California, two summers ago, I found the country people very fearful of wild animals, especially of skunks and coyotes. My Mexican boy, whom I had sent on an errand, remained perched half the afternoon in a thorny mesquite tree because he had seen a coyote and was afraid it was *rabioso.* But they fear the skunks most of all because of their habit of approaching men in the night while they sleep, and biting them on the toe or ear, or any exposed part. In defense, unusual precautions are taken to exclude them. The windows of the houses are barred with iron, and the doors are made in halves, horizontally, so that the lower part may be closed to keep out animals and snakes without interfering with free ventilation. The common people, who live in brush houses, blockade their doorways at night, and rely on their cur dogs to attack any animal which may come near.

Notwithstanding all this evidence, and innumerable ghastly stories, I remained a month in the country, at the rancho of Francis Pazik, a very intelligent and well-educated Bohemian, without seeing any rabid animals. Then, one evening just at sundown, a crowd of men came up the path, leading one of Pazik's mules and dragging the carcass of a skunk. They said that it had come out into the open field where the mule was picketed and bitten it on the hind foot. All of them insisted that it was rabid, and cited its extreme emaciation as a proof. The young man who dragged it showed me his great toe, half burned off with blue vitriol, and told me that a skunk had bitten him there two months before, and the doctors had burned it. These native "doctors" are uneducated men who live on the superstition of the people. In the case of hydrophobia their methods are characteristic. There are in the cane fields little insect-eating animals called shrews which, in that country, give off a scent so like that of a skunk that Pazik has hunted them out with his dogs in the night by mistake. The "doctors" pay as much as two dollars apiece for shrews on urgent occasions, and, mixing their bodies with herbs and roots, form a concoction which they claim will ward off hydrophobia. Besides this, they also bleed the patient and cauterize the wound.

According to the Mexicans, there are two kinds of rabies: that affecting the head and that affecting the stomach. When animals have *rabia* in the head they become stupid and move about slowly, biting at everything they see or touch. They are not violent, and become very thin. But when they have rabies in the stomach it gives them great pain, and they bark and howl and race about frantically, chasing other animals and tearing them. Mr. Cipriano Fisher, of Santa Catarina, told me of his experience with a coyote which had rabies in the stomach. He was hunting deer at Cape San Lucas, and had killed two. Carrying the smaller one and his gun to camp, he returned unarmed, except for the knife which every one wears in that region, to bring in the other. As he went down a deep cañon he heard a coyote ahead, howling in the peculiar way which he knew to be characteristic of the *rabioso*. All the hunters claim they can recognize the howling of a rabid coyote, and they say that no other animal will answer it or go near it. The howling approached rapidly. Knowing that he could not escape by running back uphill, nor kill it with his knife without being bitten, he stepped quickly into the brush and cut a long green club. As he turned back into the open place he saw the coyote down the cañon, leaping up and snapping at the air. When the coyote saw him it broke into a furious run up the trail, and when, as he says, about thirty feet away, made a flying leap at his face. He jumped to one side, struck the rabid animal in the back of the head as it passed, and killed it with the one blow.

Skunks are particularly dangerous to persons who sleep out at night. J. Ellis McLellan, a field collector of the United States Department of Agriculture, whom I met at San José del Cabo, told me of an unpleasant experience he had with a skunk while coming down from La Paz. On account of the heat he had ridden in the night as far as Agua Caliente, where he stopped near a ranch house to sleep till morning. Although the night was warm, he covered his head with a *serape* for protection from insects and wandering animals. Early in the morning he was awakened by a twitching at his blanket and, raising the *serape*, saw a skunk biting and jerking at it. Realizing the gravity of the situation, he reached for his heavy knife, and then, suddenly throwing aside the *serape*, he leaned forward and put his whole force into one blow. As he ducked under the blanket again, for protection, the dogs from the house rushed out in a body and pounced upon the dying skunk, which they worried on top of McLellan until the ranch people beat them off. When skunks bite at men's toes and ears, or at blankets in this way, it is taken as an indication that they are rabid.

Shortly after this I saw a young man at Miraflores who had just been seized with hydrophobia. Two months before he had been bitten on the great toe by a skunk as he lay asleep in his house at Agua Caliente, but had shown no symptoms of the disease until that day, when he suddenly began to bite at the door jamb in the store at Miraflores. They put him into the brick jail, where he soon became very violent. When I went down to the jail the next morning I found a group of Mexicans about the huge wooden door, which was chained fast and tied with *riatas* in addition. From the inside there came a succession of thumps and blood-curdling groans and strangles. I peered in through the barred window, and saw the unfortunate man lying on his back in a corner, spasmodically kicking out his legs from his chest and rolling his dilated eyes. Suddenly he leaped to his feet and, grasping the iron bars, shook the great door violently, chained and tied as it was. Then he seemed to leap against the walls, and at last fell down, groaning. He soon became rational again, and began to talk through a crack in the door to an old man whom I took to be his father. He asked for water, but they would not give him any, and while he was pleading for a knife or pistol another spasm seized him.

Presently the judge came over with two policemen. They said they were going to take the *rabioso* out and tie him to a tree, because he was getting the jail too dirty, and might not die for a week. As soon as the spasm passed, and the man lay weak and moaning, the burly policemen loosed the *riatas*, and, stepping in quickly, seized him from behind. He protested pathetically against going into the hot sunshine, but they pushed him out and started toward the corral to tie him up. But when the fierce sun struck him he was racked by horrible convulsions. He kicked and struggled, bit at his shoulders, and blew spittle into the air when he threw his head back. The policemen breathed hard, and the old man, his father, hugged himself in agony as he walked behind. There was a desperate struggle, then, with a final paroxysm, the *rabioso* suddenly collapsed and hung limp in their arms. At first they thought that he was dead, but when he showed signs of life they carried him to the corral and tied him to a tree before he became conscious. Two days later he died.

Pasteur himself does not undertake to cure patients who have been seized with spasms; but the judge told me that, fifteen years before, an Italian doctor had come through their country making marvelous cures. When he arrived at Miraflores there was a *rabioso* in the jail who was so badly afflicted and so long-lived that the judge had ordered him to be shot. When the Italian doctor heard this, however, he asked permission to try an experiment on the man. This being granted, he had the patient lassoed, dragged to the river, and held under water until he was apparently drowned. After the *rabioso* was full of water, the doctor rolled him on a barrel and resuscitated him; then he gave him some medicine which cured him. Cipriano Fisher told me that he had cured a valuable bulldog of rabies by this same method, using the bitter juice of the *pitahaya*, a species of cactus, for medicine. This crude means of alleged cure is unique, and seems based on the theory that the antipathy of rabid animals to water, implied in the name hydrophobia, is the cause of their death, and partial drowning, therefore, a cure.

Rabies is extremely prevalent at times in certain districts of the Cape region. McLellan says it does not occur north of the tropic of Cancer—that is, of La Paz and Todos Santos—and it is hardly known in the thickly populated district about San José del Cabo, but at Cape San Lucas, and especially also along the base of the mountains near Miraflores and Agua Caliente, where it is very hot and dry, rabid animals are greatly to be feared. While collecting in these mountains I passed several good ranches which had been deserted because, as my guide said, stock could not be raised there successfully on account of the *rabia*.

This man had worked as a *ranchero* or stock herder for two years on one of these ranches, and had been obliged at one time to kill eleven cattle and seven sheep and goats in two weeks on account of their having rabies. It was part of his duty to follow up rabid coyotes, foxes, skunks, and wild cats when he saw them or heard their peculiar cry, and shoot them before they bit the stock. But he assured me very gravely that he preferred to work in the valley for less wages rather than have charge of Chollalito rancho; and when we camped there for a night he slept on top of the pack boxes, with his bare feet wrapped in blankets and a *serape* over his head, and reverently pulled out the blessed rag he wore around his neck, in order to more surely protect himself against the rabid skunks and coyotes. There is, however, very little danger in traveling through this interesting country. Cases of hydrophobia are comparatively rare, and some scientists who have collected in Baja California have even denied its existence there. But with the traveler, as with the native, there remains the vague, constant, but unrealized expectation of seeing some raging coyote come tearing through the cactus, or of having his toe bitten in the middle of the night as he sprawls in the heat and darkness.

Professor Welldon, in the British Association, expressed his sense of the intellectual insolence of those who presume to say, notwithstanding our ignorance of animal characters, that because a characteristic seems to us minute and without importance, it is therefore without importance to the animal. Until we know the function of the animal throughout, and can picture its physiological processes thoroughly, we have no right to say, *a priori*, that this or that feature is of no use.

THE SENSE OF COLOR.

By M. ANDRÉ BRACCHI.

WHEN the different rays of the solar spectrum strike the eye separately they each produce a particular characteristic and subjective impression, which is called color. Ingenious theories have been set forth by physiologists, like Young, Helmholtz, Hering, and others, to explain the perception of colors by our eye, but the problem still awaits solution, and is not likely to be explained from that side, because it is rather psychical. The laws regulating the perception of colors are not physiological; we perceive only relations. We know that the sense of color may be modified independently of that of light and of space. Two phases may be distinguished in its evolution. Every light, whether chromatic or not, produces a simple luminous impression on the retina—a simple excitation of the optic nerve, without being analyzed by it. In the second phase the brain, the psychic center of color, intervenes. There may obviously be considerable differences between persons in the interpretation of what we call colors, and we may judge that there is an education of this psychical center, and that it is an important matter.

Different as the ways of interpreting a sensation of color may be, there are still some fundamental ideas in the matter which painters, for example, do not all observe. Some, like the impressionists, exaggerate them, and others neglect them. Which of these are wrong? and which right? are questions we are not concerned with, our purpose being to show that many of the phenomena of color, shade, sources of light, etc., escape a large proportion of persons unless they are attentive observers. If we visit the exhibitions of the impressionists we shall be entertained at the criticisms we hear over the canvases of such painters as Renoir and Monet; youths who have just come out of the drawing school declaring that their master never taught them to put blue on a face, and that in Nature all shadows are gray or black, and none red or violet; and we should astonish a great many people if we should say that a white robe should never be painted in a portrait picture with white lead alone. "All skies are blue, all trees are green, all pantaloons are red," said a celebrated painter who was trying to show how the habit of seeing a colored object in a certain way prevented one from perceiving the different colors that might be applied to it. We recollect the trouble of a brave youth who, having sat for his portrait to a celebrated painter, was distracted at perceiving green in the reflections of the hair of his likeness. Yet there are in Nature shadows that are blue and reflections that are green, and if we do not see them habitually it is because we do not give sufficient attention to them.

A common division of the spectrum is into warm and cold colors. The warm colors are red, yellow, orange, and yellow-green; the cold colors are violet, blue, green, and blue-green. This is not an arbitrary division, but answers to a fact of experience which passes from our physical to our moral impressions, and may cause in us feelings of comfort or uneasiness, joy, sadness, or moral depression. Some persons are influenced by the gray-colored sky, others are gay when the day is bright. It is a current expression that the color of the southern landscape is warm. Goethe said that blue caused him to feel cold.

The terms warm and cold are technical expressions in the arts. A color tone is cooled by putting blue in it, and warmed by adding red or yellow. "This practice is not arbitrary," says M. F. Bracquemond in his book on Design and Color; "it copies the colored aspects which natural light imposes on all imitation that seeks to realize the colored and factitious light of painting. To reach this, art observes the order according to which the natural lights distribute their various colored elements, and classes luminous aspects—a process which it has always observed—into the two categories of warm and cold. Hence, so far as examples come to us, this contrast is easy to verify; at the Louvre, for example, in works from Pompeii, and in those of all the masters." Preyer relies upon this division of colors into warm and cold for a comparison of chromatic sensations with thermic, and for supposing that the color sense is developed from the sense of temperature. Chromatic sensitiveness to this author is only a special case of thermic sensitiveness limited to the retina. Darwin's ideas were evidently the same; the whole human body was a sort of retina capable of improvement; we may, it is true, suppose with Lord Kelvin that "there is absolute continuity between the perception of heat by the retina of the eye and its perception by means of the tissues and nerves."

A very elementary experiment will easily enable us to recognize these different qualities of colors. Set a lighted candle on a table near a window; there are then two sources of light—the daylight, blue and cold, and the light of the candle, orange-red and warm. Cast a shadow on the white paper by holding a pencil straight up. The shadows cast by the candle will be blue to a degree that no one can mistake it, a greenish blue. Placing the pencil between the window and the candle and looking at the shadows, we have, first, the blue shadow of the candle, and then the shadow projected by the cold daylight. The color of the last, though perhaps less evident than the other, is an orange-yellow, of rich, warm tone.

From this little experiment we may conclude that a warm light provokes a cold shadow, a cold light a warm shadow, and that the color of the shadow is complementary to that of the light. In the experiment, daylight was the source of the cold light. Let us now take a third source of light, warmer than that of the candle, the flame produced by burning alcohol and salt—a very warm, deep orange light, which makes the light of the candle seem cold and its blue shadows appear yellow, while its own shadows are blue.

We recently observed a very striking example of these warm and cold appearances of light; it was at the theater: a beam of red light shone brightly upon an actor, whose shadow was absolutely green. Some of the people around us were astonished at the phenomenon, which they could perceive very plainly. Phenomena of this kind are produced every instant in a nature illuminated by the sun; nearly all the shadows are colored in hues which we can distinguish with a little attention where the unpracticed eye sees nothing but gray. Thus in a mountainous country, exposed to the warm light of the sun, the mountains in the horizon appear blue through the haze; then, as evening draws on, the sun appears a deeper orange, more reddish, while the sky seems green by contrast, and the red rays of the sun falling on the mountains turn them violet, in those beautiful tints which give so much glory to those countries of large shadows and bright lights.

However intense the light of day may be, it is therefore always colored, and gives those colored shadows which painters do not always observe. The painter, in fact, should make an analysis of the complex light around him, and should repeat the result in synthesis on his canvas. Upon hardly any other condition can he represent the transparency of the atmosphere, or the luminosity of a subject or a landscape. These colored shadows are not, therefore, false colors, as often seems to be believed, or optical illusions; they are really existent, but our eyes are hardly ever practiced enough to discern them; we are deficient in education of the color sense. This education is not hard to attain. There are persons who have special aptitudes and are consequently remarkable colorists, just as some persons have an admirably organized ear for music; but, besides these, it is possible for all persons endowed with the faculty of observing and capable of attention to acquire with considerable rapidity the faculty of discerning colors, where they at present hardly see anything but confused gray masses. (The epithet gray, we may observe, is used as applied to many things the color of which is not susceptible of exact determination.) Such attentive observation of colors is, however, attended with some danger to painters. Every person prefers some one color, is influenced by a particular shade.

When we examine the works of the painters we see that there are many differences in the way of seeing. Some see blue, red, green; others see clear, others obscure. In the analysis of a complex color it happens that there is sometimes an auto-suggestion. Where there is a hardly defined violet, the painter will exaggerate it on his canvas, and will be obliged, in order to keep up the right tone, to increase the intensity of the colors next to it. Hence arises a common error with painters, who start with a true principle, but are not able to apply it properly, and give their picture a tonic violet, green, or yellow, beyond all reason.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

SKETCH OF THOMAS EGLESTON.

By Prof. DANIEL S. MARTIN.

AS a general rule, the work of the scientist is not of a kind to attract conspicuous notice from the public, especially in great cities, filled and thrilled with commercial and political activity; and so it comes to pass that men of rare attainments and untiring energy, in the highest walks of life and thought, may spend their whole lifetime in such an environment, and be scarcely known outside of a limited circle of kindred minds. They may confer lasting benefits on the community, render important services to the whole country, and be widely known and honored in other lands, and yet receive but little general recognition in the place of their abode.

Such a man, in such a community, is Prof. Thomas Egleston, of the city of New York. He has been too busy and too modest to seek prominence in the public eye, and his scientific work has been of a kind that does not lend itself readily to popular lectures or startling announcements; but as a mineralogist, a metallurgist, and a mining engineer, and as the planner and founder of the great School of Mines of Columbia University, he has made a deep and permanent impress on the history of science in the United States.

Professor Egleston is of New England stock, his ancestors having been among the first settlers of Dorchester, Massachusetts, in 1635. Thence they came by a toilsome and perilous journey to Connecticut, and founded Windsor, which was thenceforward their home, and whence his father came to New York. The removal to Connecticut arose from a desire for greater freedom of life and worship than they found in Massachusetts; and Professor Egleston has been deeply interested in studying the little-known records of this movement, and the influence which it exerted, as an almost unwritten chapter in American history. He proposes to publish these researches, together with much other material relating to our colonial history, in which he is an enthusiastic student.

He was born in New York, on December 9, 1832. As a boy he took considerable interest in certain aspects of science, and at the age of thirteen had gathered a collection of minerals and rocks. He attended Yale College, and in the later years of his course took special elective work in chemistry. After graduating there in 1854, he was for a time an assistant to Prof. Benjamin Silliman, Jr. Subsequently he went abroad, partly for his health, and was advised to spend some time in Paris. With no special professional purpose, but from a general desire to improve his time, he began attending lectures on geology and chemistry at the Jardin des Plantes, under D'Orbigny (a brother of the eminent writer) and Hilgard, and he worked with much energy in the laboratories of those departments at the Jardin. He thus attracted the attention of some of the faculty of the École des Mines, who offered him larger facilities in that institution, which he at once accepted. After much very interesting study in the paleontological laboratory there, he decided to go regularly through the entire course, and accomplished that purpose with notable success and honor, graduating in 1860. He had worked as an assistant in every laboratory of the school, and in the summers had traveled through much of France, becoming familiar with its geology, mineral resources, mining works and processes, and gaining a mastery at first hand of all branches of those subjects. Those years were to him full of interest and enjoyment; friendships were formed that have enriched his whole life; and in it all the man was being remarkably prepared for the work of developing those forms of science and of industrial progress in our own country. Professor Egleston has always retained a strong feeling of attachment toward the École des Mines, which has likewise been warmly reciprocated. He has shown his interest by two gifts to the institution, of five thousand dollars each.

Returning hither in 1861, just as the war cloud was darkening over the land, he received almost immediately an appointment at Washington, to take charge of the mineralogical collections and laboratory of the Smithsonian Institution. After two years there he conceived the purpose that determined his whole career, and has so greatly influenced both American science and American mineral development—that of a school of mines at New York.

At that time there were, indeed, in this country schools of science, well organized and well equipped—the Sheffield School at Yale, the Lawrence Foundation at Harvard, the Rensselaer Polytechnic Institute at Troy, and others. But their scope was rather general in character, and there was no institution planned and arranged with distinct reference to mining and metallurgy as its main subjects. Mr. Egleston, as he was then known, saw and felt this lack, and planned to supply it.

There is not space here to detail the circumstances under which he was led to prepare, in 1863, the Plan for a School of Mines in New York; but the modest little outline then drawn up and printed has been exceedingly rich in results. It was taken up with interest by certain leading trustees of Columbia College, as it was then called, especially by the late George T. Strong. The president, the late Dr. Charles King, and a majority of the board, favored the experiment, for so it was regarded, and arrangements were finally made to begin it in the autumn of the next year, in limited quarters in the old college building on Forty-ninth Street, and with provision for but a small number of students—not over twenty. Part of the instruction was to be given by members of the existing college faculty; and three new professors were appointed to special chairs for the school, to be compensated wholly by fees therefrom. These were, Professor Egleston, mineralogy and metallurgy; Prof. Francis Vinton, mining engineering; and Dr. C. F. Chandler, chemistry.

Meanwhile, in June, 1864, President King was succeeded by the late Dr. Barnard, whose strong interest in science made him a warm supporter of the school. Already some prominent people were impressed with the value of such a movement, and disposed to aid it. A fine collection of minerals was purchased and presented by Mr. Strong, and another was given by Mr. Gouverneur Kemble.

On the opening day, November 15, 1864, the number of applicants was far beyond expectation and provision; the school was found to respond to a need and a demand that had not been suspected; it was a success from the first. In a year or two it had become an institution of recognized importance; ample quarters were provided for it in a large building, formerly a manufactory, on the Fourth Avenue side of the college block, and important additions were made to its corps of instructors—particularly the eminent geologist, Dr. J. S. Newberry, of Cleveland, Ohio, whose noble geological collection was deposited and used in the School of Mines, and whose breadth and power and personal magnetism so profoundly influenced scientific interest and progress in the city of New York for more than twenty years.

Such was the beginning of the school; its career has been one of unbroken growth and increasing influence. After some ten years it was found needful to take down the plain old transformed factory and erect a new building on its site, with larger space and improved facilities. Fifteen years later Columbia College was removed to its new site on the Morningside Heights, where now the School of Mines is installed in stately fireproof structures, wherein its great accumulated treasures of collections, apparatus, models, and varied appliances of instruction are safely and permanently housed.

The influence of this school upon science in New York city has been incalculable. Only those who have lived in touch with the scientific life of the metropolis during the period since the close of the civil war can appreciate the change that has taken place in public feeling regarding science, or can recognize how largely that change is due to the existence of such an institution, and to the presence of such a body of strong and able professors, in constant and active co-operation in the interest of science. The school attracted notice from the first, abroad as well as throughout this country. In 1871, seven years from its opening, a writer in the North American Review characterized it as "already more scientific than Freiberg, more practical than Paris," and emphasized its influence both upon science and upon mining interests in the United States, pointing out that the literature pertaining to mines and their working had been very limited in the English language, and that the instruction in the school had to be chiefly given by lectures; but that these courses would gradually develop into a literature.

These suggestions have been fully justified by the results of the last quarter century. The vast development of our mineral resources has been largely under the direction of graduates of this school. Hundreds of them are to-day in important positions of scientific trust, not only throughout our own country but in South and Central America, Australia, China, Japan, and even Europe itself. The lectures of the professors, and the articles constantly published in the School of Mines Quarterly, have indeed given us a literature of the subject in English. The local influence in the city has been great, upon scientific education in secondary schools, and upon general public sentiment; while in Columbia University the experiment has become one of its finest departments and an element of its greatest strength. Rarely is it given to a man to see in his lifetime so great a result from the plans and the labors of his earlier years.

Of the many forms of scientific activity which have engaged Professor Egleston during his busy life, only the briefest mention can be made. He was one of the founders of the American Institute of Mining Engineers, was thrice its vice-president, and was chosen president in 1886; and he has published over one hundred articles in its Transactions. He was one of the founders of the American Metrological Society, and of the societies of Mechanical Engineers and of Electrical Engineers, and a member of the society of Civil

Engineers and of the Iron and Steel Institute of Great Britain. In the New York Academy of Sciences he was active for many years, and held the vice-presidency from 1869 to 1881. In 1866 Professor Egleston was associated with the Agricultural and Geological Survey of the Union Pacific Railroad; in 1868 was appointed a United States Commissioner to examine the fortifications of the coast; and in 1873 was one of the jurors for the International Exposition at Vienna. From Princeton and Trinity Colleges he received, in 1874, the degrees of Ph. D. and LL. D., respectively, and from the Government of France the rank of a Chevalier of the Legion of Honor in 1890, and the exceptional rank of "Officier" in 1895.

His papers, published either separately or in the proceedings of the several engineering societies above mentioned, the Annals of the New York Academy of Sciences, the School of Mines Quarterly, etc., cover a wide range of subjects connected with mineralogy, metallurgy, and mining operations. In mineralogy he was especially devoted to crystallography, and his noble private collection was gathered and arranged with relation to that department. Besides his strictly metallurgical articles and treatises, he has dealt with such topics as rails, in relation to accidents; furnaces and their construction; fire-brick and refractory substances; slags and their utilization, etc.; the decay of building stones, in connection with the Obelisk; technical education, manual training, and improvement in the conditions of workingmen in mining and metallurgical occupations.

His chief published works are The Metallurgy of Gold, Silver, and Mercury in the United States, two large volumes, 1887 and 1890, and his Lectures on Mineralogy, to which may be added his Tables for the Determination of Minerals, Metallurgical Tables on Fuels, Iron, and Steel, diagrams and comparisons of crystals and crystal notation, tables of production of many of the metals, report on the Union Pacific Railroad survey of 1868, and many others.

Within the past two years Professor Egleston has withdrawn from active work in the School of Mines, and bears now the title of Professor Emeritus; his health has been a good deal impaired, and his work has passed largely into the charge of younger men who have grown up under his direction as students and assistants. During the last winter he has presented to the school his entire scientific library and his private collection of minerals above referred to, some six thousand specimens. These, in addition to the great mineralogical treasures already possessed by the institution, all gathered and arranged under his supervision, will make the School of Mines collection certainly one of the finest in the country.

Although devoted to his own special branches, Professor Egleston had given a striking example of broad interest in other departments of science in his labor of love in connection with the monument to the memory of the great ornithologist Audubon. The present writer was closely associated with him in this work, and can testify to his energy, enthusiasm, and perseverance therein. The later years of Audubon's life had been spent on Manhattan Island, in a modest but beautiful suburban home on the Hudson, above Harlem, known as Audubon Park. He died in 1851, and was buried in a family vault in Trinity Cemetery, then far out of town, now lying between One hundred and Fifty-third and One Hundred and Fifty-fifth Streets, Amsterdam Avenue, and the Hudson. The spot was remote and almost unknown, and with the death and removal of most of the family, it had fallen into neglect. When One Hundred and Fifty-third Street was to be opened through to the river, the vault, which was close to the street line, was in danger of injury; and then Professor Egleston took up the matter and proposed to the trustees of the cemetery that if they would grant another plot in a better location, he would endeavor to have a handsome monument erected by national subscription. The trustees responded warmly, and Professor Egleston undertook the work. Before going abroad in 1887 he broached the subject to the writer, and suggested that he present it during the meeting of the American Association for the Advancement of Science, which was to be held during that summer in New York. The writer gladly responded to the plan, and in August of that year laid the facts before a general meeting of the association. Much interest was expressed, but no action was taken, as had been hoped. At the first regular meeting of the New York Academy of Sciences, in October, the writer again presented the subject, with better result; and a committee was appointed by the academy, consisting of Professor Egleston as chairman, Dr. N. L. Britton, and the writer. On the return of the former from Europe the work was taken up in earnest; and under the indefatigable efforts of the chairman and of the secretary, Dr. Britton, although with many delays and discouragements, it was carried to a triumphant success.

Before the end of the year (1887) the committee had held numerous meetings, prepared and issued a circular, and engaged the co-operation of several other organizations with the Academy of Sciences, including the American Ornithologists' Union, the Agassiz Association, and the Audubon Society (for the protection of our native birds). A design was proposed by the academy's committee, and adopted by the joint committee of the several societies; this design originated with Professor Egleston, and was a striking combination of the religious, scientific, and artistic elements appropriate to the purpose. The scheme was that of a Runic cross, the only form of that

Christian symbol which can properly bear ornamental devices, according to the canons of artists and architects, and this was to be covered with reliefs of the birds, quadrupeds, and flowers that Audubon so loved and studied, and that have given him his fame as the artist-naturalist of America. The general design being approved, the selection and arrangement of the animals and birds was given to a subcommittee of specialists, consisting of Dr. J. A. Allen, Mr. G. B. Sennett, and Dr. N. L. Britton, whose duty was to secure accurate representation and artistic grouping of the forms.

In all these combined aspects this monument is doubtless unique. As it stands to-day over the grave of him whom it commemorates—graceful, dignified, and altogether peculiar—it is an honor to our city, as well as a fitting tribute to the memory of Audubon, the Nature-lover, the artist, and the Christian believer. For this beautiful thought, so nobly carried out, both American science and the city of New York are indebted to Thomas Egleston.

The progress of the effort was slow; it was not until 1891 that sufficient subscriptions were secured, and not until the spring of 1893 that all was ready for the formal ceremonies. During all this time Professor Egleston and Dr. Britton were untiring in their endeavors and unfaltering in their purpose to succeed. On April 26, 1893, the monument was dedicated with suitable exercises, of great interest, at Trinity Cemetery, and a memorial address upon the life and work of Audubon was delivered by Mr. Daniel G. Elliott, F. R. S. E., of the Ornithologists' Union, at a public meeting at the American Museum of Natural History.

Professor Egleston has also laid the citizens of New York under enduring obligation to him in another and even more important matter, the preservation of one of the most valuable of our smaller parks from the clutches of the speculator and spoiler. It is known to but few of the residents of the city that a series of determined attempts was made, some years ago, to destroy and obliterate Washington Square, in the same way in which the St. John's Park outrage was perpetrated ten years before. The method pursued in that case was by interested parties buying up property around the park and "colonizing" the houses with tenants who would either favor or consent to the vandal obliteration of that beautiful spot of rest and shade for the erection thereon of the Hudson River Railroad freight depot. St. John's Park, however, was the property partly of a corporation, partly of individuals, and the job was comparatively easy. Washington Square belonged to the city; but the same process was begun by a great real-estate magnate, and was going on toward a similar result, when the death of the arch-conspirator checked the scheme for a time. A little later, however, it was revived, under the notorious Tweed *régime*, and would have succeeded but for the keen insight and vigorous action of a few public-spirited citizens, led by Professor Egleston. Washington Square had been dug over and torn up, under the pretext of remodeling and " improvement," and the unsightly mounds and piles of earth were left for many months, not only to offend the eye, but to generate malaria. The ground had been originally a Potter's Field, and the opening and upturning of the soil, frequently unhealthy in its effect, was markedly so in that case. The south side of the square had been " worked " already, in the first attempt, and had largely lost its population of old residents; but the north side was still occupied by a select class of old New-Yorkers. Now, however, between the desolate aspect of the park and the malaria that began to be felt, an exodus of the owners on the north side was imminent. Then began to be hinted some schemes for which all this was preparatory. A great militia armory was to be erected on the western end, and other projects vaguely loomed up, involving the ruin of the park as such. A bill to legalize these schemes was quietly introduced at Albany, and had been brought nearly to its passage, by " influences " no less potent for their careful concealment. Professor Egleston and a few other gentlemen of the vicinity were anxious about these rumors, but could get no information. Inquiries from city officials were met with positive denial of any such intentions, and it was only within a few days of the time set for the passage of the bill that they succeeded in discovering its real meaning.

At this late juncture the " Public Parks Protective Association " was quietly and quickly organized by a small body of public-spirited men, of whom the late John Jay was president and Professor Egleston secretary. This association set itself to work most earnestly to reveal the danger, to arouse public sentiment and public protest, and to make these felt in the Capitol at Albany. Circulars and petitions were prepared and widely disseminated, at the cost of great labor, within the brief time left ere the bill should come up for passage. The New York Academy of Sciences, speaking in the interest of public health, passed strong resolutions of remonstrance; and various other bodies took similar action, including the Academy of Medicine.

The result was that legislators were aroused, some to the real character of measures that they had not fully understood, and others to the existence of a public sentiment upon which they had not counted, and the bill failed to pass. Nor was this all: a resolution was adopted, prepared by the association, guaranteeing the ground occupied by the square to be kept " forever " as a park for purposes of public health and recreation.

That Washington Square remains to-day, an oasis of beauty in the desert of brick and stone, and a breathing place in that densely built portion of the great city, is due principally to the watchfulness and energy of Professor Egleston. He it was who saved that park to the people of New York, and a debt of lasting gratitude therefor is owing him from them. This is an unwritten episode in the history of our city, and the present writer, who knew something of the facts at the time, is gratified to be able to put them on record now. But let us not fail to note the lesson that they convey. "Eternal vigilance is the price" of all that is valuable in a community like ours, where the demands of business greed and the devices of political schemers and "bosses" may at any time unite again, as in the past, for acts of profitable vandalism, and dismiss as "sentimental" all considerations of beauty, health, or historical association. The sanitary importance of our smaller parks is now better understood; and the city is buying property for such purposes at heavy cost, in localities where fifty years ago parks could have been laid out at little expense, and maintained at a vast saving of human health and life. Such articles, also, as that of Dr. Stephen Smith, in the February number of this monthly, are educating the intelligent community as to the sanitary value of vegetation in cities. But nothing is safe or sacred where the evil trinity of the boss, the speculator, and the "soulless" corporation may combine their forces; and the call is for ceaseless watchfulness.

Professor Egleston has been all his life in active association with the religious and benevolent work of the Episcopal Church. He became president of the Bible and Common Prayer-Book Society in 1871; was vice-president of the Protestant Episcopal City Mission Society from 1870 to 1897; a trustee of the General Theological Seminary, and a member of the corporation of Trinity Church from 1878. In connection with the last-named body some of his relations have an interest wider than his own denomination, and may fittingly be mentioned in a sketch relating chiefly to his scientific career. Two points may here be noted: the schools among the poorer classes maintained by the Trinity corporation; and the unique jeweled chalice in memory of his wife, presented by him to Trinity Church.

Aided and controlled more or less by Trinity corporation, though in different parts of the city and in connection with different Episcopal churches, are now eight schools, with about one thousand pupils. In these are taught careful and scientific methods of training along modern lines, of eye and hand development, hygiene, economy, and thrift, to children and youth of the neediest classes. Already for years much interested in these schools, Professor Egleston has, since his withdrawal from professional activity, given much of his time to their advancement, and has found intense gratification in observing the results of this training among a class of children that, from their general environment, would grow up to be a burden or a menace to the city. The intelligent culture of hand and eye, the mental quickening and moral uplifting, the capacity and purpose of honorable self-support, and the protection from moral and social perils, that are imparted and secured through the agency of these schools, are to him a constant source of enthusiasm.

The jeweled chalice above referred to is of scientific interest from the great variety and rarity of the gems with which it is set. During years of travel to and from many parts of Europe, Professor Egleston had remarkable opportunities, in his visits to mining regions and his intercourse with mineralogists, to obtain fine and choice specimens of gems; these he had mounted in elegant forms as presents to his wife, Mrs. Augusta McVickar Egleston. Her death, in 1895, was a very great blow to her husband, as their married life had been extremely happy; and the only satisfactory use to which this beautiful treasure of jewelry could be put seemed to him to be in the services of divine worship in the church. It is not possible in brief compass, without a figure, to describe the arrangement of these jewels on the base, stem, and cup of the golden chalice; but it must suffice to say that there are one hundred and eighty stones set in, with embossed work, on a cup and pedestal nine inches high and half that width. The species and varieties number fifteen, many of them in rare shades of color; among them are the ruby-colored Siriam garnets, green "demantoid" garnets of the Ural ("Uralian emerald"), Ceylonese moonstones, colored diamonds, sapphires, both yellow and green (Oriental topaz and emerald), rubellites, red zircon, moldavite (the rare green obsidian of Moravia), green tourmaline, chrysoberyl, the rich purple amethysts of the Urals, etc. Considered either mineralogically or as a work of art, this chalice is almost unique; while the conception and designing, which are wholly of Professor Egleston's own, reveal the same union of artistic and scientific qualities that was shown in the Audubon monument above mentioned, joined with a religious and a personal sentiment almost too sacred to dwell upon in a sketch like the present.

In all these aspects of his life and work, as we said at the beginning, Professor Egleston has been little known to the general public; but among scientific and engineering circles he has been highly honored. In these pages he may become more widely known, and the people of the metropolis and of the country at large may learn something of the manner of man that has lived and labored so honorably among them, and has done so much for science and his fellow-men.

Editor's Table.

SCIENCE AND THE IDEAL.

WE have had frequent occasion in these columns to refer to the tirades against science indulged in by writers who, because they can not quite make ends meet in their philosophy of the universe, strangely allow themselves to think that *science* must be at fault. At one moment it is M. Brunetière, at another Tolstoi, at another it is a Harvard professor or a Western school superintendent; but no very long time elapses before we find somebody in very unnecessary trouble, as it seems to us, over the shortcomings of science. The last sufferer to whom our attention has been drawn is Dr. John Beattie Crozier, the author of two able works—Civilization and Progress, and History of Intellectual Development—who has lately written a history of his own intellectual development under the title of My Inner Life. This writer describes the effect upon his mind of a study of Mr. Spencer's Principles of Psychology. "Then it was," he says, "that the ideal within me, struck to the heart, shriveled and collapsed." This sad result was due to the discovery, forced on him by a study of the work in question, that all our mental experiences have equally a material basis, and that from a material point of view or, as we may say, seen from below, one thought or feeling is as much justified as any other. Previously he had considered that "such higher faculties as veneration, benevolence, conscientiousness, and the like, were quite distinct in essential nature from low ones, like revenge, lust, vanity, cowardice, and deceit"; but now "all this was changed, and all the faculties alike, the high and the low, the noble and the base, the heroic and the self-indulgent, lay on a dead level of moral and spiritual equality . . . all alike being but vibrations, vibrations, vibrations, nothing more." Consequently, "the dethroned Ideal fell prone and headlong like a false and usurping spirit; and my mind, bereaved of that which had been its life, settled into a deep and what, for a year or two, threatened to be a permanent intellectual gloom."

It is a great pity that at this critical moment a very simple consideration did not occur to this troubled spirit. When we read the Sermon on the Mount we read "words, words, words"; when we read some horrible piece of profanity or indecency it is again "words, words, words"; when we read the demonstration of a proposition in Euclid it is "words, words, words"; and, again, when we take up Tennyson's In Memoriam we find that its whole tissue is "words, words, words." But would it tend in the least to lessen one's reverence for the Sermon on the Mount to be reminded that it was constructed out of the same verbal elements as the piece of profanity? or would it diminish our admiration for In Memoriam to be told that it was constructed of words just like the dullest piece of prose? If not, then why should one be so terribly disconcerted and depressed to find that all our mental life finds its basis in vibrations? Or why should the inference be drawn that, because the basis is one, all that reposes on it must also be one in character and meaning? Is our delight in the lily or the rose impaired by the reflection that it springs from the same soil that produces noisome weeds; or do we gaze on the humming bird with less admiration because it flies in the same atmosphere as the bat? Why should "vibrations" not be the condition of existence of one mental phenomenon as well as of another? Surely the very fact that Dr. Crozier classes all the feelings he mentions as mental affections should prepare him to believe that they have a common basis. But how feelings shall be classified and ranked *after they have taken form* is a question precisely similar to the question how the various combinations of words should be classified and ranked. In the latter case words are the basis of them all, but we say: "This is an epic poem; this is a moral essay; this is an immoral novel; this is a silly joke; this is a market report." Are these distinctions illusory because words are the basis and substance of all these various forms of composition? Does the poem lose anything of its beauty, or the essay anything of its ethical value, because each was not composed of elements altogether peculiar to itself? The solid globe itself was once a diffused nebula, but we do not on that account find a less varied beauty in flower and tree, in hillside and running brook and grandly flowing river.

In his sad condition of mental disarray our author betook himself, he says, to the counsels of Thomas Carlyle. That sage, when he heard that his visitor had been reading Spencer, made some uncomplimentary remarks about the latter which we hardly think the visitor was justified in repeating. Apart from this, Carlyle told him in effect that, as he was in the world, he had just to make the best of it, and that in time he would find work that he could do with benefit to himself and others. Finally, our author made what he calls a discovery and offers as a contribution to modern philosophy—namely, that in the mind of man there is a "scale," according to which thoughts and feelings are appraised. Some are high up on the scale and some are low down. He found that there is that *in* the mind which is not *of* the mind, and which sits in judgment on all the contents of the mind — something which smiles on every right action and frowns on every wrong one, and yet which he does not care to speak of as conscience. Here was the antidote he required to the "pure and undiluted materialism" which had so paralyzed his moral being in the Principles of Psychology; and, having obtained it, he has been living happily, as we gather, ever since.

We have tried to do justice to the originality of Dr. Crozier's conception, but really with indifferent success. That there is a scale by which we are all accustomed to measure the varying values of our thoughts, feelings, and actions hardly needs to be stated; and that there is substantial agreement between men on the same plane of civilization as to the relative values of different mental products is also unquestionably true. What our author has not shown is how this conflicts with the strict scientific position taken in the Principles of Psychology. He does not tell us that he has repudiated the teachings of that work; indeed, he gives us distinctly to understand that, so far as it affirms the dependence of thought upon physical organization, he adheres to it still. If so, he has only built upon it a superstructure which it was always open to him to build; so, why he should find fault with the foundation it is not easy to see. Science goes as far as she can see her way to go in setting forth the relations between the mind of man and the environing universe. It studies also the human mind in its historical manifestations, and tries to unfold the laws of human conduct. It confines itself to facts which are believed to admit of verification and to inferences which have been tested by experience. This is the contribution of Science to the theory of human life. But because Science stops here she does not lay any veto on thought, desire, or hope. She lays a foundation; it is for us to build thereon "gold, silver, precious stones, wood, hay, stubble," each of us according to our own impulse and upon our own responsibility. The fire of experience will "try every man's work of what sort it is." But not only may we build, we must build; no one can live upon another man's philosophy. We may adopt this creed or that, but it means nothing to us till we have worked it over in our own mind and made it our own—with modifications.

There is nothing whatever in science that conflicts with the ideal. Strictly speaking, science brings us to the threshold of the ideal, and leaves us there. "These are the facts of life," it says; "such has been the course of human history. The human race has risen from humble origins to its present commanding position in the world; and to-day the standards of human conduct and the conditions of human happiness are very different from what they were in the distant past. Social ties have multiplied and strengthened. Domestic affections have grown in depth and tenderness, and individual happiness is now bound up to a very large extent in the happiness of other individuals. The cruel superstitions of the past have given way in many minds to a reverent regard for a power which is felt to rule in the universe. Of such a power Science can not render any exact account; but before all the ultimate questions of existence Science is dumb; nor can it attempt to reconcile the antinomies which assert themselves in all phenomena. It is for you, the individual, entering upon life, to make your choice of the course you shall hold and the principles by which you shall be governed. The senses are the guides to immediate pleasure, but the experience of the ages has settled with considerable approach to certainty the conditions on which enduring happiness is to be won.

> " 'Choose well; your choice is
> Brief and yet endless.' "

To the man who insists on being knocked down with a club before he will yield to persuasion there is nothing in such a mode of address that will be convincing. This is a case in which, as Pascal says, "there is enough light for those who desire to see, and enough obscurity for those who want a pretext for not seeing. . . . Perfect clearness might help the understanding, but it would injure the will." There is, therefore, room on the scientific foundation for the idealism of Dr. Crozier, and for many other forms of idealism. It is for each one of us to construct his own ideal, and, having constructed it, to live by it. "If any man's work abide he shall receive a reward."

RACIAL GEOGRAPHY.

The interesting papers contributed to this magazine by Prof. William Z. Ripley, which, we are glad to say, will soon be published in a more permanent form, indicate very clearly the remarkable progress that has been made of late years in the scientific study of human origins. Formerly legend and tradition were the only sources of light upon prehistoric times; and the sagacious Thucydides dismissed all speculation respecting those ages with the curt remark that he did not think the people who lived then amounted to much, any way. No doubt he was nearer right in this opinion than were those who peopled antiquity with demigods and heroes; still there was much of interest to be gleaned respecting the prehistoric past if only right methods of research had been used. This was too much to expect in his day; and, indeed, it is only in very recent times that the study of human origins has been placed upon anything like an adequate scientific basis. A reference to Mr. Ripley's work will show how numerous are the lines of investigation now pursued. Language, which at one time was considered an all-important test of origin, has fallen from its high position; and theories which, on the strength of linguistic evidence, were very widely entertained, have lost their authority. Particluarly has this been the case with the so-called "Aryan" theory. It was simple and beautiful and interesting, but as observations accumulated it became more and more untenable, until finally it had to be discarded.

The problems which the anthropologist and ethnologist attack are indeed of the highest degree of complexity. If our predecessors went astray therein, we ourselves are only feeling our way very cautiously and somewhat uncertainly. We have not yet reached an era of victorious generalizations. Professor Ripley well indicates the difficulties of the research. Things will go well for a considerable time along certain lines of observation until the facts come to be gleaned in some special field, and then the result will perhaps be just the opposite of what theory required. In a brachycephalic region, for example, where craniological and other tests call for a population of short stature, the stature will reveal itself as much above the average. In a region where, looking at race characteristics as elsewhere established, the tendency, say, to suicide should be particularly low, it is found by statistics to be particularly high. The ethnologist finds his path strewn with endless difficulties of this nature, and yet he is not discouraged. The truth lies somewhere, and he knows that a vigorous and courageous sifting of the facts will be sure to bring it to light, if not to-day, to-morrow. We gather from Professor Ripley's pages a strong impression of the confident patience with which the true man of science attacks his problems; he is sure that his *methods* are right, and that in the end they must triumph.

The interesting points of view which the study of racial geography presents are numberless. This is particularly shown in Professor Ripley's chapter on Modern Social Problems. In this chapter the writer acknowledges, as he does elsewhere, that theories of race and of heredity have sometimes been pushed too far. He demands a due recognition of the influence of environment, and cites cases where environment will explain divergences from what are recognized as race characteristics or tendencies. An example of this is afforded by the case of Brittany, in connection with separateness of home life. The population of Brittany belongs to a race that is particularly prone to such separateness, and yet in Brittany there is an unusual intermingling of families under one roof. We can not enter into the explanation here, but Professor Ripley shows how the physical geography of the country may account for the variation from type. In the same chapter the writer shows very interestingly how the Celtic parts of France manifest almost invariably conservative tendencies: how they shun divorce, afford a very low rate of suicide, and, in the matter of crime, tend rather to deeds of violence than to acts of dishonesty. The general impression which the intelligent reader will gather from the whole work is that "racial geography" has all the interest of a rapidly growing science; but that, while much has been accomplished, much more remains to be done. The lines of research are many, and we may reasonably hope that before long the combined labors of anthropologist, ethnologist, and sociologist will give us a coherent body of knowledge and theory which shall not only illuminate the past but be of the very highest value for the comprehension of the problems of our own day.

Scientific Literature.

SPECIAL BOOKS.

In a study of what constitutes the foundations of zoölogy we know of no one better equipped to discuss the various problems than Professor Brooks.* As an original investigator in many groups of invertebrate zoölogy, as a student of animal life in temperate and tropical seas, as a special teacher of embryology and zoölogy for a quarter of a century, and, above all, as a profound student of the philosophical literature of the subject, his equipment is thorough and complete. A fair review of this work would be difficult without voluminous quotations from its pages.

The reader will find here the soundest, healthiest acceptance of the Darwinian theory of natural selection. He penetrates the mists and fogs of philosophical vagaries and follows the dictum of Tyndall, who, in presenting the essentials of a discussion, says, "Not with the vagueness belonging to the emotions, but with the definiteness belonging to the understanding" we are to study these matters. It is fact, fact, fact. The honest "I do not know" inspires the reader with a confidence that obscure points are not to be juggled with. He insists that the principles of science are physical, that a mechanical interpretation of Nature is reasonable and just. Referring to Huxley, he remarks that faith and hope are good things, no doubt, and (quoting from Huxley) "expectation is permissible when belief is not," but experience teaches that expectation or faith of a master is very apt to become belief in the mind of the student," and (again from Huxley) "Science warns us that the assertion which outstrips evidence is not only a blunder but a crime."

In the chapter of Nature and Nurture he brings many potent facts and arguments against the idea of the transmission of acquired traits. Without copious extracts it is impossible to do justice to this masterly presentation of the subject. The chapter abounds in aphorisms, as indeed do other portions of the work; and these alone, if serially collated with their contexts, would make a valuable little handbook for the student of biology. His chapter on Lamarck is equally strong, and the fallacies of Lamarckianisms have never been so clearly shown. "The contrast between what we may call the solicitude of Nature to secure the production of new beings, and the ruthlessness with which they are sacrificed after they have come into existence, is a stumbling-block to the Lamarckian, and the crowning glory of natural selection in that it solves this great enigma of Nature by showing that it is itself an adaptation and a means to an end, for the sacrifice of individuals is the means for perfecting the adjustments of living things to the world around them and for thus increasing the sum of life."

* The Foundations of Zoölogy. A Course of Lectures delivered at Columbia University on the Principles of Science as illustrated by Zoölogy. By William Keith Brooks, Ph. D., LL. D., Professor of Zoölogy at Johns Hopkins University. Pp. 339. The Macmillan Company.

"Whole books have been written on the marvelous fitness of the structure, the instincts, and the habits of the worker of the honeybee for its life of active industry—a life in which the male has no share, and from which the female is cut off by her seclusion in the depths of the hive, and by her devotion to her own peculiar duties. While the queen and the drones are well fitted for their own parts in the social organization of the hive, these duties are quite simple, and very different from the duties of the workers; and as these latter do not normally have descendants, and as they never under any circumstances have female descendants, all the workers are the descendants of queens and not of workers.

"Their wonderful and admirable fitness for their own most necessary part in the economy of the hive must, therefore, be inherited from parents who have never been exposed to those conditions to which the workers are adapted; and this adaptation can not be due to the inheritance of the effect of these conditions, nor can we believe that they are inherited from some remote time, when the workers were perfect females or when the queens were also workers; for the sterile workers of allied species differ among themselves, thus proving that they have undergone modification since they became sterile.

"Here we have a most complicated and perfect adjustment of marvelous efficacy to external conditions which are of such a character as to prove that the inheritance of the effect of these conditions has had no part in the production of the adaptation."

His views of bird migration, based on the matter of ovulation and not on food supply, are extremely interesting. He says: "As their eggs are very large and heavy, a high birth rate is incompatible with flight, and the preservation of each species imperatively demands that every egg shall be cared for with increasing solicitude; for while in other animals increased danger to eggs or young may be met and compensated by an increase in the birth rate, the birth rate of birds can not be much increased without a corresponding restriction of the power of flight. Every one knows how quickly birds may be exterminated by the destruction of their eggs or young, and the low birth rate of all birds of powerful flight is a sufficient reason for migration, for at the same time that their fitness for flight limits the birth rate, it permits them to seek nesting places beyond the reach of their enemies."

His critical estimate of Huxley is tersely presented. He says: "His evolution is not a system of philosophy, but part of the system of science. It deals with history—with the phenomenal world—and not with the question what may or may not lie behind it.

"The cultivation of natural science in this historical field and the discovery that the present order of living things, including conscious, thinking, ethical man, has followed after an older and simpler state of Nature, is not 'philosophy' but science. It involves no more belief in the teachings of any system of philosophy than does the knowledge that we are the children of our parents and the parents of our children; but it is what Huxley means by 'evolution.'"

Dr. Brooks credits Galton with employing simple terms to express new and abstruse truths, and we trust those who are continually wrestling with the dead languages to pick out new and distracting words to express their conceptions will profit by Galton's method.

The lecture on Natural Selection and the antiquity of life is replete with original and pregnant suggestions based upon the results of his own profound investigations on pelagic life. Here again only ample quotations from his pages would convey an adequate idea of their value and importance. In his chapter on Louis Agassiz and George Berkeley he gives this just tribute to Agassiz:

"The writer was a man of transcendent genius for scientific discovery, with intense earnestness and enthusiasm for the pursuit of truth, and rare eloquence and literary skill. If any man was devoted to the cause of truth and determined to accept it, whatever it might prove to be, that man was Agassiz; for while his impulses were notably devout and reverential, he proved, on many occasions, that he was fearless and independent in the search for truth. It is no disparagement to Buckland and Bell and Chalmers and the other authors of the Bridgewater Treatises to assert that Agassiz far surpassed them all in acquaintance with the methods which lead to success in the interpretation of Nature, and in ability to treat the problems of natural theology from the standpoint of the zoölogist."

He dedicates his book to Bishop Berkeley, and throughout the lectures his references indicate a thorough acquaintance with the writings of this eminent scholar.

Paley's old watch comes in for renewed consideration, and one wonders if the mainspring of this device will ever be broken. His apt references to classical authors indicate wide and judicious reading. The book is overburdened with thought and clear, concise reasoning, and his final advice should be followed when he urges his readers to do double duty by reading the book again.

In the April number (1898) of this magazine we had occasion to review the first two volumes of this work.* A perusal of the third volume does not permit us to modify the expressions and criticisms there made. We then said the work is "a compact storehouse of facts, a veritable ethnological museum, and this feature alone renders the book indispensable to American students." The author "shows no evidence of ever having seen the magnificent series of volumes issued by the United States Bureau of Ethnology." "The author in several instances confounds Japan and China." "His treatment of the African races is by far the most exhaustive." These extracts will apply most particularly to the present volume. The negro races of the interior of Africa and those of West Africa, as well as the cultured races of that continent, are exhaustively treated. In that portion treating of the history of the civilization of eastern Asia the Japanese and Chinese are considered together and many mistakes in generalization follow as a result of this confounding. Long before we get to this portion of the work an illustration is given of Japanese agricultural instruments, in which only one plow of the many types in Japan is presented, and this is evidently taken from a model. Not only has he confounded the Japanese with the Chinese, but the southern Malays are brought in when he speaks of the Malay and Japanese love of the cockfight—a practice which is unknown in Japan. He refers to the Japanese latrine as being built over running water, whereas the record of this custom is found only in an ancient Japanese classic of the seventh century. He is in error in stating that the stage is essentially the same in China and Japan. His description of the music of Japan applies to China only. The statements that pearls play a large part in the ornaments of the Japanese, that the

* The History of Mankind. By Prof. Friedrich Ratzal. The Macmillan Company. Vol. III, pp. 599.

fireproof buildings are of stone, that the Japanese tobacco is moistened with opium, that the Japanese street dress is full of color, are all erroneous. His description of the sash worn by men is the description of the woman's sash. He says "the Japanese currency before the change to dollars and cents was like that of the Chinese." Had he consulted Snowden's description of ancient and modern coins, etc., he would have found this correct statement in regard to Japanese coins: "In their shape, composition, and relation to each other they present some striking features which set them apart from every other system of coinage in the world."

The illustrations are badly distributed. Through pages of description of the Japanese and Koreans, in which little is said about the Koreans, are scattered illustrations of the inhabitants of Yeso—the Ainu. The illustration of Japanese table furniture depicts only utensils for smoking and wine-drinking, and some of these are erroneously labeled, as are those of certain Chinese utensils.

We trust that the Asiatic portion of this valuable work will be written over again, and in doing it the author will realize that he is dealing with four or five hundred million people widely separated in language, modes of writing, customs, and manners; that he will consider the Ainu, Korean, Japanese, Chinese, Thibetan, and Indo-Chinese with the same thoroughness that he has given to the separate groups of the African continent; that he will draw his information from modern sources and collections properly labeled and up to date.

Even with the defects pointed out the work will prove of great value to the American student, as it brings before him the richness of the ethnological museums of Europe.

GENERAL NOTICES.

The Development of English Thought * is "an attempt to present a theory of history through concrete illustrations." The book does not deal with the facts of history—a knowledge of these is assumed—it throws into relief certain salient features of each epoch which were instrumental in forwarding the social consciousness. It may, indeed, be called a philosophy of economics. It has a theory to propound: Survival is determined and progress created by a struggle for the goods for which men strive, or the means by which they may avert evil. These goods change, together with the environment dependent on them. Hence arise new activities; the race is modified, new modes of thought come forward, and finally the characteristics of the civilization are reconstructed. These changes are subject to a definite law of evolution, repeated in each new environment. England has been chosen for this economic interpretation of history; because of its insular position, its development has been more normal and indigenous, less subject to foreign influences since the Reformation, than any continental country. An explanation of the psychological theory underlying the book serves as general introduction. The antecedents of English thought are found among the early Germans, and the Early Church. The fifteenth century, with its inventions and discoveries, revolutionized men's ways of living and thinking. Then the Calvinists and Puritans imposed their standards of good and evil. These are followed by the great English thinkers: Locke, who marks the beginning of Deism in England; Mandeville, Hume, and Smith, developing the economic side; Whitefield and Wesley leading the religious revival. Later on, Malthus, Ricardo, and Mill formulated the Economic Philosophy, whereas Darwin, the first of the biologists, imposed biologic habits of thought on economic inquiry. The concluding chapter, while cautious in the

* The Development of English Thought. A Study in the Economic Interpretation of History. By Simon N. Patten, Ph. D. New York: The Macmillan Company. 1899. $3.

discussion of current problems, attempts, assisted by the lessons of the past, to indicate the probable future movement of thought, springing out of present economic conditions.

Mr. *Wilbur S. Jackman* has sought in preparing his manual of *Nature Study for Grammar Grades*,* to propose a few of such problems arising in a thoughtful study of Nature as are within the comprehension of grammar-school pupils, and to offer suggestions designed to lead to their solution. Directions may perhaps be given by the teacher—that is, by some teachers, but very few—but even if he knows how, it is hardly possible for him to make them as systematic to so large an extent as would be required by a school of inquiring pupils; and such a plan as the author offers may be accepted as a valuable help. Take, for instance, the first lesson on the mutual relations of plants and insects—as to plants. The student is told what equipment to take, what places to visit; is reminded of seven kinds of evidence in the shape of galls, stings, eaten leaves, etc., to be considered; and is given a list of queries to be recollected in studying the phenomena, in their general aspect, as to the benefit or injury received by the plant from insects, the attractions it offers, and the defenses it possesses, with "number work" relating to the extent of the depredations, and methods of representing the results of the study in picture. The book contains forty-five such lessons on different aspects of Nature.

In the preparation of his book on *Fertilizers* † it has been the aim of Mr. *Voorhees* to point out the underlying principles and to discuss, in the light of our present knowledge of the subject, some of the important problems connected with the use of fertilizing materials. While the author recognizes the lack of definite knowledge on many vital points, he considers it desirable, when the investigations of the experiment stations are becoming so important and they are so well prepared to study the fundamental principles of plant nutrition, for the practical man to have a clear understanding of what is now known. The book treats of the natural fertility of the soil and the sources of the loss of the elements of fertility, the functions of manure and fertilizers and the need of artificial ones, the different classes of fertilizers, the chemical analysis of them, and the methods of using them with their special application to various crops.

We have received, with only a short interval between them, the first volume of a third edition and the fourth or last volume of the second edition of *Alfred H. Allen's Commercial Organic Analysis*.* The former volume is first to reach us. It is a high testimony to the value of the work in itself that the publication of a rival issue of the edition of 1885 had been begun by another house, although its age, as suggested by the date, would indicate that it had much need of revision. During the thirteen years since the publication of this edition later research has thrown new light on many features of the science and processes, and has corrected many of the old conceptions, and the author's views on some points have changed in the light of the more recent results, so that the preparation of a new edition had become necessary. Mr. Allen has found it now impossible for him to undertake the continuous labor which would be imposed by such a task, and the work of revision has been undertaken by Henry Leffmann, of Philadelphia. For this new edition Mr. Allen

* Nature Study for Grammar Grades. A Manual for the Guidance of Pupils below the High School in the Study of Nature. By Wilbur S. Jackman. Danville, Ill.: The Illinois Printing Company. Pp. 407.

† Fertilizers. The Source, Character, and Composition of Natural, Home-made, and Manufactured Fertilizers; and Suggestions as to their Use for Different Crops and Conditions. By Edward B. Voorhees. New York: The Macmillan Company. Pp. 335. Price, $1.

* Commercial Organic Analysis. A Treatise on the Properties, Proximate Analytical Examination, and Mode of Assaying the Various Organic Chemicals and Products employed in the Arts, Manufactures, and Medicine. By Alfred H. Allen. Third edition. Illustrated. With Revisions and Appendix by the author and Henry Leffmann. Vol. I. Introduction. Alcohols, Neutral Alcoholic Derivatives, Sugars, Starch and its Isomers, Vegetable Acids, etc. Philadelphia: P. Blakiston, Sons & Co. Pp. 557. Price, $4.50.

The same work. Second edition. Revised and enlarged. Proteids and Albuminous Principles, Proteids or Albuminoids. Same publishers. Pp. 584. Price, $4.50.

has furnished material on the subjects of the Kjeldahl process, proteids of wheat flour, vinegar, brewing sugars, malt substitutes, hop substitutes, and secondary constituents in spirits. Information has been added by the American reviser, partly from suggestions by Mr. Allen on the subjects of specific gravity, formaldehyde, vinegar, methyl, alcohol, acetone, fusel oil, argol, starch, glucose, invert sugar, lactose, and wine, and brief notes on other topics. Processes of the American Association of Official Agricultural Chemists have been reprinted. The revision of Vol. II is well in hand, and will be much more extensive than that of Vol I.

On the other hand, the revision of the second edition has extended over fourteen years, and is only just completed with the fourth volume, which appears a few weeks later than the volume noticed above. The earlier volumes have been long out of print, and are destined, of course, to be supplanted by those of the new revision. The present fourth volume, being newer and of the present date, will serve as the latest till the last volume of the new revision is reached; and, besides, the author hopes to publish an appendix to each volume, containing the more important of the later results. The meaning of the term Commercial Analysis has been somewhat extended, and matter has been included that in closest strictness does not belong under it, it being thought better, the author says, to include all facts possessing an analytical or practical interest to him, in the belief that what he finds useful himself will be of value to others.

In *The Porto Rico of To-day* * a traveler's view of that interesting island and its people is presented by Mr. *A. G. Robinson,* who went there and remained during August, September, and October, 1898, as correspondent of the New York Evening Post. While the book can not be regarded, as it does not profess and is not intended to be, as a source of geographical or statistical information, it admirably fulfills the design of the author to present a picture of the people and of the country as he saw them; and it is a very living picture too. He looked with a sharp eye, and has recorded what he saw in graphic style. In the author's story of his early days of the island we are made acquainted with the various names it has had, of which Porto Rico, or Puerto Rico, is only the latest. The oldest of the European names appears to have been Buriquién, in some one of the dozen or more spellings it has had, one of them being Bo. It has also been called La Isla de Carib, San Juan Bautista, etc. After the account of the author's first general impressions and experiences he describes the city of Ponce, his visit to a coffee district, a number of typical towns and villages, the journey from Ponce to San Juan, the highways, railways—of which there are one hundred and forty-three miles in operation and one hundred and seventy-five miles under construction—and a fairly effective telegraph system, views of the industrial possibilities and commerce of the island, with some experiences of military campaigning.

The publication of the revision which Mr. *Herbert Spencer* is making of his Synthetic Philosophy in order to incorporate in it as far as may be the results of more recent advances begins with the first volume of *The Principles of Biology.** The advance during the last generation, Mr. Spencer thinks, has been more rapid in the direction of this science than any other, and though the hope of bringing a work on biology at large up to date could not be rationally entertained at the author's age and under the existing conditions of his physical strength, a similar service to a work on the principles of the science did not seem impossible. Numerous additions have been needful. What was originally said about vital changes of matter is supplemented by a chapter on Metabolism. A chapter is added on The Dynamic Element in Life. The insertion of some pages on Structure fills a gap in preceding editions. The revelations of the microscope on cell life and multiplication are set forth. A supplementary chapter on Genesis, Heredity, and

* The Porto Rico of To-day. Pen Pictures of the People and the Country. By Albert Gardner Robinson. New York: Charles Scribner's Sons. Pp. 240, with maps. Price, $1.50.

* The Principles of Biology. By Herbert Spencer. In Two Volumes. Vol. I. Revised and enlarged edition. New York: D. Appleton and Company. Pp. 706. Price, $2.

Variation gives the results of further evidence and further thought in that line, qualifying and developing certain views enunciated in the first edition. Various modern ideas are considered under the title Recent Criticisms and Hypotheses. The chapter on The Arguments from Embryology has been largely rewritten. Smaller additions appear in the form of new sections incorporated in pre-existing chapters. The assistance needed in the work of revision has been given by Prof. W. H. Perkin in Organic Chemistry and its derived subjects; Prof. A. G. Tansley in Plant Morphology and Physiology; Prof. E. W. MacBride and Mr. J. T. Cunningham in Animal Morphology; and Mr. W. B. Hardy in Animal Physiology. In all sections not marked as new the author desires it to be understood that the essential ideas set forth are the same as they were in the original edition of 1864.

Prof. *Silas W. Holman* attempts the presentation, in *Matter, Energy, Force, and Work*,* of some of the fundamental ideas and definitions of physics in a plain and logical manner. His purpose is not to set forth the experimental side of the subject or to describe phenomena or laws. He rather assumes a slight knowledge of these, and proceeds to develop the concept and definitions. The author regards a clearer thinking on these subjects as of special importance to engineers and members of the other technical professions, because correct views upon them have become essential in those professions through the progress of the applications of science to the industrial arts. These applications are likewise of considerable interest to the untechnical members of the community. Professor Holman has composed his book with the principle of presenting the subject of physics in logical sequence, and has divided it into two parts, the first of which contains the matter immediately proper to the subject, with discussions of substance or matter, motion; energy and its forms; force; kinetic energy, force-measurements, work, potential energy, and matter again, as distinguished from substance. The second part comprises summaries of the chief theories of the nature of matter, force, and energy, including the kinetic theory of gases, Le Sage's theory of gravitation, the vortex-atom theory, and a discussion of the nature of energy and matter, with observations on chemical energy and the ether.

The *Short Course in Music*, prepared for use in schools where a complete course is not thought necessary, by *F. H. Ripley* and *Thomas Tappen*, is embraced in two books, of which we notice the second (American Book Company). Familiar songs are made the basis of instruction, some of those which appear as melodies in Book One being repeated here in full score. All other material has been prepared especially for this book. The music and directions are adapted equally for unchanged and changed voices. Voice training and the elements of phrasing and expression are furnished in a group of *solfeggios* at the close of the book. Theory is given in condensed form, but one that, it is claimed, embraces all the essential elements of vocal music.

Mr. *J. E. Marr* has prepared his exposition of *The Principles of Stratigraphical Geology* (Cambridge University Press; The Macmillan Company, New York, $1.60), under the belief that an idea of the subject can be obtained most satisfactorily if a large number of the details connected with the study of the stratified rocks are omitted. He has accordingly given very brief accounts of the strata of the different systems, paying more attention to the bearings of the facts than to their enumeration. The history of the earth is presented as a connected one, in which one period is linked on to the next, every event that occurs introducing a new complication into the conditions, which are consequently never quite the same—the changes showing an advance from the simple to the more complex. The study proves that an enormous period elapsed subsequent to the formation of the earth and previous to the deposition of the stratified rocks, of which we have only the slightest, if any, knowledge. The stratigraphical geologist has to establish the order of succession of the

* Matter, Energy, Force, and Work. A Plain Presentation of Fundamental Physical Concepts, and of the Vortex-Atom and other Theories. By Silas W. Holman. New York: The Macmillan Company. Pp. 257. Price, $2.50.

strata for the chronology, and to ascertain as far as he can the conditions existing during the deposition of the several strata or groups of strata. After an account of the growth and progress of stratigraphical geology, the nature of the stratified rocks and the law of superposition are discussed; the test of included organisms and the methods of classification are explained, the evidences of conditions under which strata were formed, and other theoretical points are considered, and the several geological systems or periods are enumerated under the English nomenclature. Finally, the various estimates of geological time and the bases on which they are made are reviewed.

The American Book Company publishes as a part of the Eclectic System of Industrial Drawing an excellent manual of the *Elements of Perspective*, by *Christine Gordon Sullivan*, of the Cincinnati public schools. It consists of explicit directions and rules on the general principles of the art, with applications in Isometric Projection and Oblique Perspective, given in concise form and simple, clear language, amply illustrated, and supplemented by problems, in solving which the rules are made practical.

A convenient manual on *Gas and Petroleum Engines* has been prepared by *A. G. Elliott* from the French of *Henry de Graffigny* for Whittaker's Electro-Mechanical Series, in recognition of the interest that has been awakened in the application of such engines to supply the place now occupied by horses in drawing vehicles. One chapter deals exclusively with the theory of the gas engines. Other topics treated of are the history of the gas engine, the description of existing gas engines, carbureted air engines, petroleum engines, gas-generating plants, engines for use with poor gases, and the maintenance of gas and oil engines. (The Macmillan Company, 75 cents.)

Laboratory Exercises in Anatomy and Physiology (New York: Henry Holt & Co., 60 cents) have been prepared by *James Edward Peabody* for practical application. The precept is emphasized that the pupil should be led to see that most of the materials required for observation and experiment are furnished by the organs and tissues of his own body. Directions which have been found in the author's experience necessary to guide the pupil in his observations and experiments are given at the beginning of each topic. The questions following them contemplate the student's seeking the facts from the material itself, and he is expected to be trained to distinguish observed results from the inferences that may be drawn from them. Some home study is contemplated, the results to be afterward reported in class. The book consists almost entirely of directions for experiments, and is interlined with blank sheets for recording observations.

Geographical Nature Studies (American Book Company) is intended by the author, *Frank Owen Payne*, to assist the teacher, and by pointing out the relations, often unrecognized, between familiar phenomena and home geography to guide the study of the class to definite and practical ends. The lessons are intended to fit the comprehension of the youngest pupils, to promote the cultivation of habits of accurate observation, and to stimulate a desire for more knowledge and broader views of the world. They lead directly up to the point where the more formal study of geography from a text-book begins. The lessons may be used as reading exercises and for topical recitations, and exercises are introduced which may assist the cultivation of the power of correct verbal expression in the statement of facts. The exercises concern weather, animals, physical phenomena, and objects about us, and are very various.

Impressions of Medusæ have been observed on the Jurassic lithographic limestones of Solenhofen, and some "problematic fossils" on the Lower Cambrian rocks of Sweden have been regarded as derived from Medusæ. Certain nodules, bearing what looked like flattened-out starfishes—"star-cobbles" they were called—have been found among the fossils of the Coosa Valley, Alabama. Director *Charles D. Walcott*, of the United States Geological Survey, concluded that these also represented Medusæ, and began an investigation of them which involved a comparison with the Swedish and Bavarian specimens, and was at last enlarged so as to embrace all fossil Medusæ. His work is now published as a separate memoir, *Fossil Medusæ*, as one of the Monographs of the United States Geological Survey (Vol. XXX). The Middle Cambrian Medusæ are first described, and then, in order, the Lower Cambrian of the United States and of Sweden and Bohemia and the Jurassic of Bavaria. The text is illustrated by forty-seven excellent plates.

A new edition, revised and with additions, of the *Mechanics* and *Heat* of *Edward L. Nichols* and *W. S. Francis* is published by the Macmillan Company ($1.50). The book is the first volume of the Elements of Physics of the authors, which is complete in three volumes. We find in it no explanation of the nature and extent of the revisions and additions.

The publication of such a book as *Catering for Two*—Comfort and Economy for small Households (G. P. Putnam's Sons, $1.25)—has been suggested to *Alice L. James* by the difficulty of reducing the average rules of the cookbook to meet the wants of a family of two or three. The work embodies the results of sixteen years' experience in labor and study, and the author hopes that with it the way may be made easier for others whose bills of fare may be made for two. The directions are claimed to be throughout exact and reliable, and the dishes to be nourishing, appetizing, and inexpensive. The author's plan is to take a bill of fare with a comfortable variety of dishes, and direct explicitly how each is to be prepared.

The manual on *Testing Milk and its Products*, prepared for dairy students, creamery and cheese factory operators, food chemists, and dairy farmers, by *E. H. Farrington* and *F. W. Noll*, has reached a fourth edition, the first three editions having been exhausted in about a year. The present edition has been thoroughly revised, and such additions have been made to it as have been necessary to bring it up to date. It has been adopted as a text-book or reference-book in the dairy schools of twelve States of the Union and in a number of schools in Canada. (Published by the Mendota Book Company, Madison, Wis. $1.)

The Silver Cross, or the Carpenter of Nazareth (International Publishing Company, New York), is a short story selected and translated from The Mysteries of the People of Eugène Sue, and published for the sake of the illustrations it is supposed to afford of the tyranny of the ruling class and the oppression of the working people and the poor and their suffering thereby which prevailed in the grand days of the Roman Empire, as well as always before, and is assumed to have continued down to the present. It is the story of the life and sufferings of Jesus of Nazareth, told in the thrilling style of the great French novelist.

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Fragments of Science.

The New Zealand Experiment in Woman Suffrage.—The right of suffrage was given to all the women of New Zealand in 1893 without any concerted action or aggressive demonstrations on their part by the free, almost unsolicited, vote of the men. The general election took place in November of the same year, and is described in the Saturday Review as having been a warm contest, with several questions on which public opinion was sharply divided; but "on the whole, the women took matters wonderfully coolly. They flocked in thousands to the public meetings, where, by common consent, the front seats were given up to them." Contrary to expectation, they displayed little emotion, and even had to be "coached" to make a pretense of enthusiasm. "Polling day was awaited with dread by the electioneering agents and returning officers, with doubt by veteran politicians, and with pleasurable excitement by the women." They all voted, and "what did it all lead to?" "It left things very much as they were. . . . Gradually but irresistibly the conviction forced itself upon the New Zealand mind that the women knowing little and caring as little about political details, had voted almost always with the men of their family and class. Sharing to the full the prejudices, hopes, and interests of their fathers, brothers, husbands, and lovers, they had cheerfully doubled the voting power of these. Where, as in the case of schoolmistresses and factory girls, they had some special bond of union other than domestic they had voted very much as schoolmasters and male trade-unionists had voted. . . . With one accord colonists ceased to be afraid of what the suffrage might do, and began instead to complain of it for not doing more. Only here and there careful observers note that groups of women are studying politics, and foresee that, as years go by, these will supply a new and intelligent force with distinct and logically reasoned aims of its own."

The Metric System (a Letter to the London Times).—Sir: I see that on Wednesday next, the 22d inst., the President of the Board of Trade is to receive a deputation from the Decimal Associations and others to urge on the Government, not merely the adoption of the decimal system of notation, but the compulsory application within two years of the metric system of weights and measures in its entirety. I have been hoping to see a letter in the Times from some person of importance calling attention to this deputation. I fervently trusted I should notice one from your correspondent, Mr. Herbert Spencer, who, a year or so back, contributed a series of thoroughly well-thought-out and logical articles, exposing the fallacy of the metric system; but if any such letter has appeared I have, unfortunately, missed it. I believe this agitation to be largely due to scientific professors who have been brought up on foreign books, and have found it too much trouble to convert foreign measurements into English; further, due to the promptings of a number of foreign merchants, forming (happily, or unhappily) now so large a portion of our traders—men who, also, do not wish to take the trouble of converting foreign weights and measures into English. As regards the suggestion, made time after time, that the metric system is one giving the greatest simplicity to calculations, I say unhesitatingly, from very considerable experience, that it is one absolutely subversive of mental arithmetic, and I appeal to anybody who has ever had the misfortune to wait at the *guichet* of a French railway station while the clerk inside has been calculating the total amount to be paid for two first-class and one second-class from "A" to "B" with a piece of chalk, or pencil and paper, to compare the speed and the certainty of this process with the answer that he would get at Euston, or at any such station in Great Britain, and say which system shows by results the advantages in point of time and in accuracy. The French themselves, as has been pointed out on more than one occasion, find the metric system too irksome, and they evade it. According to the metric system, one of its great merits is that you can state every required quantity by multiples or submultiples of ten—metre, 1; decimetre, 0.1; centimetre, 0.01; millimetre, 0.001. But no Frenchman thinks of expressing himself in this way. Instead of 0.01, he says cm. 1. For a millimetre, he says mm. 1. When he comes to large weights, does he not commonly abjure the 1,000 kilos and write one tonne? When he comes to domestic weights the kilogramme is found too large; the half of this, the practical equivalent of the pound, is wanted. He ought to write 500 grammes. He does not. He abjures his decimals, and writes one half kilo. But I feel I must not take up your space by multiplying instances, so well known to many who have studied the subject, of the unbearable burden of the decimal *plus* metrical system compulsorily carried out. I well know the value of decimals, and the indispensable need of their use in many circumstances; but I object to being compelled to use them when they are not needed and are in the way. I find it easier to state seven eighths, and to deal with it mentally, than to put it into the form of .875. I do not wish to be restricted by law in the use of my tools. What would be thought of the law which compelled a shipwright on all occasions to use a chisel, and never to employ the adze. I, with, I believe, every upholder of English weights and measures, and of the use of fractions, am quite willing that the metric system should be made legal in its entirety throughout Great Britain; but we are not willing that the useful weights and measures which we can employ with so great facility and accuracy should be made illegal. Let the two exist together, and experience will prove which is the one preferred by the community. I am, sir, your obedient servant,

FREDERICK BRAMWELL.

5 GREAT GEORGE STREET, WESTMINSTER, S. W., *March 18, 1899.*

P. S.—Very probably the old stalking-horses will be trotted out on Wednesday, and the President of the Board of Trade will be told of the confusion created by the existence of mere local weights and measures. I believe that if those who cite these anomalies were asked to give instances at various dates it would be found that these local weights and measures were dying out. In any event they are illegal, and are not obligatory upon anybody. Every man can claim to deal according to the standards of length, of weights, and of capacity. Most certainly the introduction of the metric system would largely add to the use of illegal weights and measures, not only locally, but generally. If the inquiry were made in France, even no farther off than Boulogne, it would be found that, in the markets there, dealings are frequently carried out on a local system unconnected with the metric.—F. B.

Variations in African Religious Ideas.—Miss Kingsley observes, in her West African Studies, that when you are traveling from district to district you can not fail to be struck by the difference in character of the native religions you are studying, and that no wandering student of the subject in western Africa can avoid recognizing the existence of at least four distinct forms of development of the fetich idea. They have every one of them the same underlying idea, and yet they differ. "And I believe," Miss Kingsley says, "much of the confusion which is supposed to exist in African religious ideas is a confusion only existing in the minds of cabinet ethnologists from a want of recognition of the fact of the existence of these schools. For example, suppose you take a few facts from Ellis and a few from Bastian and mix, and call the mixture West African religion. You do much the same sort of thing as if you took bits from Mr. Spurgeon's works and from those of some eminent Jesuit and of a sound Greek churchman and mixed them, and labeled it European religion. The bits would be all right by themselves, but the mixture would be a quaint affair." Of the four main schools of fetich predicated by Miss Kingsley, the Tshi and Ewe school (Ellis's school) is mainly concerned with the preservation of life; the Calabar school with attempting to enable the soul successfully to pass through death; the Mpongwe school with the attainment of material prosperity; and the school of Nkissi with the worship of the mystery of the power of evil.

A Natural History Society as a School.—Among the agencies employed by the Boston Society of Natural History for making itself a vehicle of instruction to the public has been the employment of an educated man and teacher as guide to the museum, who should also give lectures there. The salary of this officer has heretofore been provided by the bounty of Miss Harriet E. Freeman, but she has been obliged to discontinue her contribution, and the curator is now seeking other means of maintaining a suitably qualified assistant. The "guide," Mr. A. W. Grabau, delivered a course of lectures in April and May, 1897, on "The Surface of the Earth: Its Rocks, Soil, and Scenery," in which special attention was given to the scenery in New England; and, whenever it was practicable, excursions were made to localities which could be used as illustrations. A similar course, delivered in 1896, resulted in the formation during the summer of the same year of a class of thirty persons, summer residents of Kennebunkport, Maine, who were under Mr. Grabau's daily instruction for two weeks. The awakening of interest in local scenery further led to his giving lectures in Belmont and Arlington, and he thereby became instrumental in a movement intended to preserve the local frontal bowlder moraine on Arlington Heights—a valuable geological movement. A course of lectures on the Animals of the Shores of New England was given by Mr. Grabau to a class of from forty to seventy-five persons, in the Teachers' School of Science, with excursions on Wednesday and Saturday afternoons. In a similar fall course attention was given specially to the study of animals in their various habitats.

A course by Mr. Grabau on the use of the microscope and the preparation of specimens was followed by ten days' laboratory work in Limekilns Bay, Maine. One of the results of a winter course on zoölogy, to a class of twenty teachers, was the formation of the Hale House Natural History Club, in connection with which field meetings are held, classes for children are formed, and papers upon elementary subjects are read and discussed. Other courses of lectures are mentioned in the report of the curator of the society—the field lessons in geology, by Professor Barton, with a winter course in historical geology; the course of Dr. R. W. Greenleaf, on the elementary structure and function of the parts of flowering plants; the course of the curator (Alpheus Hyatt), on elementary zoölogy; and the lectures on geography, by Prof. W. M. Davis.

Glacier Water.—An analysis of two samples of water from the Illecilliwaet Glacier, in British Columbia, was recently made by F. T. Shutt and A. T. Charron. The water was collected a few feet from the glacier's irregular face, about a mile and a half from the glacier station on the Canadian Pacific Railway. The following is abstracted from an account in the Chemical News:

	No. 1.	No. 2.
	Parts per	million.
Free ammonia	0.018	0.018
Albuminoid ammonia	0.027	0.037
Nitrogen as nitrates and nitrites	0.0246	0.0442
Oxygen absorbed in fifteen minutes	0.0396	0.0672
Oxygen absorbed in four hours	0.1056	0.1744
Chlorine	0.10	0.10
Total solids at 105° C.	30.8	12.0
Solids after ignition	30.8	8.0
Loss on ignition	None.	4.0
Phosphates	None.	None.

The authors go on to say: "From the above data we may unhesitatingly conclude that the glacier water is one of great organic purity. The samples are not identical, due no doubt to the fact that they were collected twelve days apart, and probably from different parts of the foot of the glacier. Both analyses, however, show that, judged by the standards used in the diagnosis of ordinary potable waters, it is a water possessing a high degree of purity, and one perfectly wholesome and eminently suited for drinking and household purposes. As received, both samples were quite murky, almost milky, in appearance. On allowing them to stand, perfect subsidence took place, leaving the supernatant water colorless and brilliant. A microscopic examination of the sediment showed it to consist of very fine rock matter, chiefly fragments of quartzite.

Protection of Plants and Birds in France and Italy. — Organized efforts for the protection of native plants and birds from further destruction are multiplying in Europe. Botanical stations for Alpine plants have been established at several places in France and Switzerland, and now Italy has come into line with the association *Pro Mortibus*, which, founded in July, 1897, has already more than five hundred adherents. Italy is probably the country where work of this kind is most needed, for nowhere else is the destruction, particularly of birds, so systematically, persistently, and industriously carried on. *Pro Mortibus* will also interest itself in the preservation and replantation of the forests. Among other efforts looking in a similar direction, M. J. Corcelli tells in *La Nature* of the establishment of shelters in connection with the schools in Saxony where birds are fed in the winter, and of lessons given to the children inculcating regard for them. A great deal has been accomplished in France without much noise in rewooding the devastated slopes of the mountains and erecting efficient safeguards against ravage by torrents—largely by restraining the torrents at their sources; and the Alpine forests of the country, M. Corcelli says, "are again rising from their ashes." Reserves of Alpine plants have been established by the Belfort section of the French Alpine Club on the *Ballon* of Alsace; the central section is creating an extensive botanical garden in the Vosges, to serve as a place of refuge and propagation and multiplication of species threatened with extinction. The city of Annecy, in Savoy, has recently voted the money required for establishing a similar garden on the verdant ridges of the Semnoz. Two local societies in Italy are engaged in a similar work, one of which has established the garden museum Chamousia on the slopes of the Saint Bernard, where plants from the Pyrenees and the Himalaya are also collected. Switzerland is not behind either of these countries in this work.

Tortoise Shell.—The following interesting account of the tortoise-shell industry is taken from Nature: The tortoise shell of commerce is obtained from the horny superficial plates overlying the bony case of the great majority of tortoises and turtles. Turtles differ from tortoises in the heart-shaped form of the upper half of the shell, and the conversion of the limbs into paddles adapted for swimming. The upper part of the shell carries a median row of five large superficial horny plates, flanked on either side by a row of four or five still larger flat plates; these thirteen or fifteen large plates affording some of the most valuable commercial tortoise shell in the particular species whose shell is in most demand. On the front and hind edges of the upper bony shell and the portion connecting the latter with the plastron, or lower shell, are a series of smaller horny plates, generally twenty-four in number, which are sharply bent in the middle and are known in the trade as "hoof." The under surface of the shell of a turtle carries six pairs of large, more or less flat, horny plates, for which the trade term, derived from their uniform color, is "yellow belly." In value they sometimes exceed all but the very finest of the large upper plates, generally known simply as "shell." Of the host of land and fresh-water tortoises, most of which are of comparatively small size, the horny plates (which, by the way, are altogether wanting in the so-called soft tortoises of tropical rivers), on account of their thinness and opacity, are now of no commercial value, at least in England. Moreover, it is by no means all species of marine turtles which yield commercial tortoise shell. Of these marine turtles, exclusive of the great leathery turtle, there are three well-marked and perfectly distinct types, severally represented by the green or edible turtle, the hawksbill, and the loggerhead. The hawksbill furnishes the most valuable shell. The largest and best plates, which are in the middle of the back, are about a quarter of an inch thick in the center, and measure about thirteen by eight inches, their weight being from about half a pound each to as much as one pound. The length of the carapace (the upper shell) in the hawksbill is about forty-two inches. It is found in all tropical and subtropical seas. From a dead turtle the plates of tortoise shell can be readily detached by beating. The highest price realized during 1898 in the London market was about 112*s.* 6*d.* (about $28) a pound for the very best selected shell. It is stated that 76,760 pounds of hawksbill shell were sold in London in 1898. The shell is very readily workable, being made partially plastic by immersion in hot water.

Poison in Wild Cherry Leaves.—Instances having been brought to the notice of the directory of the New Hampshire College Agricultural Experiment Station of cattle presumably fatally poisoned by prussic acid from eating wild cherry leaves, the subject has been investigated by Fred W. Morse and Charles D. Howard. Five species of wild cherry grow in New Hampshire, of which the red cherry and the horse plum are not regarded as dangerous, and the dwarf cherry has not been examined, but is strongly suspected. The wild black cherry is the most noxious species, and the chokecherry is not far behind it. The poisonous principle in these cherries is hydrocyanic or prussic acid, which, however, does not exist in the leaves as such, but is derived from the amygdalin they contain. The popular opinion that only the wilted leaves are specially dangerous is not borne out. The authors found both wilted and fresh leaves poisonous, and the dried leaves worthy to be regarded with suspicion. Vigorous, succulent leaves from young shoots, which are the ones most likely to be eaten by cattle, are far more poisonous than the leaves from a mature tree or stunted shrub. The largest amounts of prussic acid were derived from leaves wilted in bright sunlight to about seventy-five per cent their original weight, or till they began to appear slightly limp and lose their gloss. Leaves wilted in the dark were much less dangerous.

Dr. Brinton's Contributions to American Linguistics.—At the suggestion of the late James Constantine Pilling, Dr. D. G. Brinton has prepared an analytical survey of his contributions in the field of American linguistics, which have now extended over forty years. The list includes seventy-one titles of books and papers, of which sixteen are classed as general articles and works. The first four of these are occupied with the inquiry whether the native American languages, as a group, have peculiar morphological traits that justify their classification as one of the great divisions of human speech. Dr. Brinton finds a feature—incorporation—which, under the form polysynthesis, is present in a marked degree in nearly all of them. Another paper shows that the various alleged affiliations between American and Asiatic tongues are wholly unfounded, and another pleads for more attention to American languages. A volume of nearly four hundred pages —The American Race—was the first attempt at a systematic classification of all the tribes of North, Central, and South America on the basis of language. It defines seventy-nine linguistic stocks in North America and sixty-one in South America, pertaining to nearly sixteen hundred tribes. Other volumes in the list include writings, preferably on secular subjects, by natives in their own languages. One contains a list of native American authors, and notices some of their works. Another vindicates the claim of native American poetry to recognition. These works were followed by the Library of Aboriginal American Literature, of which eight considerable volumes were published, each containing a work wholly of native inspiration, in a native tongue, with a translation, notes, etc. Fourteen other publications relate to North American languages north of Mexico, thirty-two to Mexican and Central American languages, and ten to South American and Antillean languages. Many of these articles were collected in 1890 and published in a volume entitled Essays of an Americanist. It was arranged in four parts, relating respectively to Ethnology and Archæology, Mythology and Folklore, Graphic Systems and Literature, and Linguistics. The value of Dr. Brinton's labors will be realized by all persons who know how rapidly things purely native American are passing away.

Metallic Alloys of Rich Colors.—A remarkable alloy of gold seventy-eight parts and aluminum twenty-two parts, discovered by Messrs. Roberts-Austen and Hunt, has a characteristic purple color which can not be imitated; for if the designated proportions of the constituents are varied from, the base is entirely changed. The compound lacks somewhat in the qualities of resistance and malleability. The color is abnormal in that it partakes of none of the color features of its constituents, as is the case in most combinations of metals. Thus, the colors of copper alloyed with zinc or tin pass gradually from red to white, according to the proportions of the constituent metals. In the union of two metals of white or bluish-white color, like zinc, tin, silver, and aluminum, the color of the alloys is not perceptibly different from that of the components—that is, it continues white. The purple of the gold aluminum alloy is not, however, the only exception to this rule. Aluminum gives highly colored compounds with several other metals, even when the second metal is clearly white. In the experiments of Charles Marcot, of Geneva, in alloying aluminum with platinum, palladium, nickel, and cobalt, combination took place abruptly at red heat, with the development of an intense temperature and a partial combination of the aluminum; and when platinum is the second metal, an explosion is liable to occur. An alloy of seventy-two parts of platinum and twenty-eight of aluminum had a bright golden or yellow color, which varied under slight changes in the proportions of the elements to violet green or coppery red. The alloy is hard and brittle and of crystalline structure. The yellow form is stable, while the other forms decompose in a short time. An alloy of seventy-two parts palladium and twenty-eight aluminum is of fine coppery rose color, crystalline texture, hard and brittle, and suffers no change with time. An alloy of from seventy-five to eighty parts cobalt and twenty to twenty-five aluminum is straw-yellow, inclining to brown; when just formed it is externally hard and scratches glass, but is easily broken with a hammer, and falls to a powder in a few days. An alloy of eighty-two parts nickel and eighteen aluminum has a pronounced straw-yellow color, is as hard as tempered steel, and resists the blow of a hammer. The fracture, close-grained, is that of steel or bell metal. It is susceptible of a fine polish, is stable, and keeps its colòr. Though interesting on account of their colors, these alloys, except that of nickel, are not suitable for any use.

The Chemistry of Sausages.—The *Lancet* is authority for the following: "The composition of the sausage is not only complex, but it is often obscure. It is supposed to be a compound of minced beef and pork. Abroad, however, the sausage is compounded of a much wider range of substances. These include brains, liver, and horseflesh. Occasionally they do not contain meat at all, but only bread tinged with red oxide of iron and mixed with a varying proportion of fat. Horseflesh is rich in glycogen, and this fact enables its presence in sausage meat to be detected with some amount of certainty. The test, which depends on a color reaction, with iodine has recently been more carefully studied and with more satisfactory results, so that the presence of five per cent of horseflesh can be detected. At present there is no legal provision for a standard in regard to the composition of sausages, but clearly there ought to be. Limitations should be laid down as to the amount of bread used, as to the actual proportion of meat substances present, and as to the coloring matters added to give an attractive appearance of fresh meat. Sausages are extremely liable to undergo decomposition and become poisonous, owing to the elaboration of toxic substances during the putrefactive process. Bad or rancid fat is very liable to alter the character of a sausage for the worse. Thus in some instances the use of rancid lard has rendered the sausage after a time quite phosphorescent, an appearance which indicates, of course, an undesirable change. The smoked sausage is a much safer article of diet than the unsmoked, since the curing process preserves the meat substance against decomposition by reason of the empyreumatic bodies present in the wood smoke which is used for this purpose."

Photographing Papuan Children.—Many savages dislike to have their pictures taken, some being restrained by motives of superstition; but in New Guinea Professor Semon found being photographed a great joke for all the boys and girls. He had much trouble in isolating a single individual, so as not to get thirty or forty persons into his picture instead of the one he wished to immortalize. "Wishing," he says, "to portray one young girl of uncommonly good looks, I separated her from the rest, gave her a favorable position, and adjusted the lens, surrounded all the while by a crowd of people behind and beside me, the children cheering, the women most ardently attentive, the men benevolently smiling. Evidently my subject was proud of the distinction she enjoyed and the attention vouchsafed her. Quite suddenly, however, this simple savage, untaught as she was and innocent of the laws of reticence and prudishness, became convulsed with shame, covered her eyes with her hands, and valiantly resisted every attempt to make her stand forward as before. At the same time I noticed that the hue of her features changed, the brown of her face becoming darker and deeper than before, a phenomenon easily explained by the fact of the blood rising into her head. Had she been a brown girl we would have said that she blushed. At all events, the physiological process was the same as that which forces us to blush." At another time, when the author had got two little girls into position to be photographed, their mothers came up and forbade his taking them that day, but promised to present them on the morrow. On the next day "both the little angels were solemnly brought to meet us nearly smothered in ornaments, their hair decorated with feathers and combs, their ears with tortoise-shell pieces, their little throats surrounded by plates of mother-of-pearl and chains of dingo teeth, legs and arms hung with rings and shells, teeth, and all sorts of network. . . . Here, again, one may see that mothers are made of the same stuff all over the world, Papuan mammas being equal to any of our peasant women or fine ladies in the point of vanity as far as concerns their children."

Meat Extracts.—An interesting account of the history and preparation of meat extracts was recently given as a lecture before the Society of Arts (English) by Charles R. Valentine. The idea of concentrating the body of an ox into a thimbleful of elixir seems to have been a very old one. Until the work of Justus von Liebig, about fifty years ago, however, little progress of practical value was made toward this end. Liebig macerated finely divided beef in cold water, or in water not above 150° F. The water dissolved from sixteen to twenty-four per cent of the weight of the dry flesh. This infusion was heated, the albumen and red coloring matter of the blood coagulated, and was separated as a flocculent precipitate. The remaining solution has the aromatic taste and all the properties of soup made by boiling the flesh. The infusion was then evaporated at a gentle heat. The residue amounted to about twelve or thirteen per cent of the original (dry) flesh. This is in rough outline the process of meat-extract making. This extract is simply an evaporated beef tea, containing the extractive matters of beef, and in virtue of these possesses medicinal and dietetic properties of value. But it is in no sense a substitute for beef, as the latter's most important food constituent—albumen—it does not contain.

MINOR PARAGRAPHS.

It appears from tables of Some Statistics of Engineering Education, compiled by President M. E. Wadsworth, of the Michigan College of Mines, that such education has been, in the United States, on the whole a thing of comparatively recent date, the oldest school, the Rensselaer Polytechnic Institute, having been established in 1824; the next, the Lawrence and Sheffield Schools, in 1846 and 1847; and the Columbia School in 1863. Civil engineering has led in this country, and has had various periods of advance, as in 1887–'88, and depression, as in 1896–'97. Mechanical engineering progressed till 1886–'87, when the number of students fell off, and the same happened with electrical engineering, "which further suffers a natural reaction from having been greatly overdone." As a rule, most of the schools in the United States seem to run to specialties, one or two of the courses being usually more conspicuous than the others.

The importance of some arrangement by which vessels may be informed of each other's approach in fog and darkness has given rise to many devices; the only one, however, which has as yet proved practical is the fog-horn or siren, and this has many disadvantages. Several fatal collisions at sea during the past year have given rise to renewed interest in the subject, and a number of new methods have been suggested. M. Branley, a French physicist, in a note presented to the French Academy suggests that each vessel be provided with a number of extremely sensitive magnetic receivers, or coherers, and a powerful magnetic transmitter. Periodical signals being made with the transmitter, corresponding impressions would be made upon the receivers of approaching vessels. The principal difficulty with this scheme lies in the fact that the receivers of a vessel will be affected by its own transmitter. There are several methods by which this difficulty may be overcome, however. Different signals may be employed, or the interval between signals may be regularly varied. M. Branley calls attention to the influence of a metallic envelope surrounding a coherer, and shows that when the coherer is thus completely surrounded it is unaffected by the influence of a transmitter. By thus inclosing the receiver on a ship at the instant of the operation of the transmitter of the same vessel, the above difficulty might be avoided.

While we can not collect roses from our gardens in January and maple blossoms from the woods in February, yet, as Prof. W. J. Beal shows in a bulletin of the Michigan Agricultural College

Experiment Station, our trees and shrubs in their winter garb furnish excellent lessons for the profitable employment of pupils during many weeks at that season in true botanical study. "Let each member of a class be provided with a branch, a foot or two long, from a sugar maple, and then spend some ten to twenty minutes or more quietly looking at the buds and the bark, with its scars and specks, and then tell what he has discovered, venturing to explain the object or meaning of some of the things he has seen. In a similar manner let each look over a branch of beech and then point out the difference between the two kinds." Opening buds of trees may be obtained at any time during the winter by placing the lower end of the stem in water for a week or two while in the schoolroom.

Eivind Astrup, in his book With Peary near the Pole, gives admiring pictures of the natural innocence of the uncontaminated Eskimos of northern Greenland, where are communities in which "money is unknown, and love of one's neighbor is a fundamental rule of action; where theft is not practiced." All things are held in common, and falsehoods are told only to spare the feelings of the listener. Among the instances of the native kindliness of these people is one where a dog had eaten up a reindeer coat, yet was only remonstrated with by its owner. When the author suggested that a hungry dog should be punished for stealing a piece of blubber, the owner said that it was himself who deserved the thrashing for not having obtained sufficient food for the dog.

The operations of the Illinois State Laboratory of Natural History during 1897 and 1898 were almost wholly connected with the work of the State Entomologist or with that of the Biological Station. The former work related to various insects injurious to crops. The operations of the Biological Station were carried on with more reference to completing a formal report upon the fishes of Illinois. The work is conducted with a view to the acquisition of correct ideas of the relative abundance and local distribution of species, their haunts, habits, regular migrations, and irregular movements, their building times and places, rate of growth, food, diseases, and enemies—and, in short, the whole economy of each kind represented at the station and of the whole assemblage taken together as a community group. Extensive studies of aquatic entomology were made, and a paper on ephemerids and dragon flies is nearly ready for the press. No part of the work of the station, however, attracts more attention among scientific men, or is likely to lead to more interesting and important results, than the plankton work, or the systematic study of the minute forms of plant and animal life suspended in the water. Water analyses have been extensively made in connection with these studies, which, combined with the continuous biological work, will, when generalized, furnish a substantial and authoritative body of knowledge of the conditions of the waters of the middle Illinois previous to the opening of the Chicago drainage canal, useful for comparison with the results of similar studies made after that event. A summer school was conducted, with fifteen pupils, in 1898, and publications were issued.

NOTES.

The Pasteur monument was dedicated at Lille, France, the city in which the subject of the memorial performed his earlier more important researches, April 9th. The ceremony was witnessed by a large assembly, which included many eminent scientific men of France and foreign countries, among whom men engaged in similar researches to Pasteur's were especially represented. The monument, the fruit of a public subscription, represents Pasteur standing on the summit of a column of Soignies stone, holding in his right hand an experimental flask. At the foot of the column a woman presents her child, which has been bitten by a mad dog, for treatment. To the left is a group representing inoculation—a woman, personifying science, injecting serum into a child she holds on her knees. Three bas-reliefs represent respectively Dr. Roux inoculating a sheep for anthrax, Pasteur studying fermentation, and the first antirabic inoculation of the young Joseph Meister, who is held by his mother, wearing the broad-flapped Alsatian bonnet. The statue is in light bronze, and with the gilded bas-reliefs harmonizes well with the gray of the stone. Addresses were made by M. Armand Gautier and M. Duclaux, who said that the improved laboratories now enjoyed by scientific institutions in Paris were largely due to Pasteur's efforts.

The minor planet recently discovered by Witt, remarkable as having an orbit that comes within that of Mars, and provisionally known as DQ, has been named Eros. An examination by Professor Pickering and Mrs. Fleming of the Harvard photographs has revealed traces of this body on twelve plates taken in 1893 and 1894, and on four plates of 1896. By the aid of these plates it has been possible to determine its elements with greater accuracy than would otherwise be possible. Its mean distance from the sun is 1.45810, its shortest distance 1.13334, and its greatest distance 1.78286 that of the earth; the eccentricity of its orbit is 0.222729, and its period is 643.10 days. Its synodical period is such that it has three oppositions in seven years. The next opposition will be in the last months of 1900, and will be a moderately favorable one for observation.

The courses in pure science of the New York University include undergraduate, graduate, and summer courses in mathematics, physics, chemistry, geology, and biology, with laboratory privileges and provision for special students and independent work in chemistry. The university last year was attended by 1,717 students in its three faculties and six schools, and 720 nonmatriculant students and auditors. A new feature this year is the inauguration of the Charles F. Deems lectureship of philosophy, under an endowment of $15,000 by the American Institute of Christian Philosophy, with Prof. James Iverach, D. D., of the Free Church College, Aberdeen, Scotland, as the first lecturer. A feature of the university organization is the institution of a woman's advisory committee co-operating with the council. A woman's law class is supported by the Woman's Legal Education Society, the purpose of which is to make business women and women in private life acquainted with existing law.

The new Science Building of the City Library, Springfield, Mass., recently completed, is being inaugurated by a Geographical and Geological Exhibition. It includes the best and latest maps, models, globes, charts, relief maps, and photographs, special attention being paid to the most effective modes of teaching. One of the most attractive features of the exhibition is the work from the Springfield public schools.

An ingenious method for thawing out frozen water pipes has been used by Prof. R. W. Wood, of the University of Wisconsin. It consists simply of passing a current of electricity through the pipe. In one case it is said that one hundred and fifty feet of frozen pipe was thawed out in eighteen minutes. The ordinary street current was used, the voltage being reduced to about fifty.

In a summary of inspectors' reports of the Hartford Steam Boiler Inspection and Insurance Company for 1898 it is stated that of 78,349 boilers, inspected both internally and externally, during the year, there were 11,727 dangerous defects discovered and 603 entire boilers were declared unsafe for further use.

The recent death list of men known in science includes the names of Charles Naudin, an eminent French botanist, Dean of the Botanical Section of the Academy of Sciences and author of a book on Hybrids in the Vegetable Kingdom, at Antibes, France, March 19th, aged eighty-four years; Dr. G. W. Leitner, an eminent Orientalist and linguist, Lecturer on Oriental Language at King's College, London, Principal of Lahne College, and Registrar of Punjaub University, where he introduced the use of their own language and literature in teaching Indian students, founder of the Anglo-Indian Institute at Woking, England, and author of works in Education, the Races of Turkey, The Races and Languages of Dardistan, Græco-Buddhist Discoveries, and other Oriental subjects, at Bonn, March 24th, in his sixty-ninth year; Dr. Angelo Knorr, Docent in the Veterinary School of Munich, February 22d; Elizabeth Brown, astronomical observer and author of papers on solar phenomena, at Cirencester, England, March 6th; Dr. Wilhelm von Müller, Professor General Chemistry in the Institute of Technology, Munich; Dr. Friedreich von Lühmann, mathematician, at Straslund, Prussia; Dr. Charles Fortuun, mineralogist, in London; Alfred Feuilleaubois, author of researches on Fungi, at Fontainebleau, France; Dr. Heinrich Kiefert, a geographer and cartographer whose fame was world-wide, whose maps and atlases are everywhere recognized as authorities, at Berlin, April 21st, aged seventy years; and Prof. Sophus Lie, of the University of Christiania, an eminent mathematician, February 18th, in his fifty-seventh year.

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SCIENTIFIC METHOD AND ITS APPLICATION TO THE BIBLE.

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"TRAINED and organized common sense" is Professor Huxley's definition of science. There is probably no better.

The popular mind persists in thinking that there is a wide difference between science and knowledge in general. Yes, there is a wide difference, but it is just the difference that there is between a trained and organized *body* of men for the accomplishing of some great work, and a *crowd* of men unorganized and undisciplined. What unscientific knowledge has accomplished may be roughly seen in the condition of savage races to-day; while the changes wrought by knowledge trained and organized, in enlarging the sum of knowledge, in extending men's power of perception, and in increasing the facilities not merely for living, but for living well, are changes in comparison with which all others recorded in history are trifling.

It will be profitable for us, in order to get a clearer idea of scientific method, to trace as briefly as possible the history of science and the development of the scientific idea.

The very beginning of science is beyond our ken. We can form no idea of just what stage in the intellectual development of the race witnessed the rise of training and order in men's knowledge. Long before the dawn of history there must have been some degree of orderliness in men's knowledge—some grouping of facts, and reasoning from one thing to another. Rude classification would be made, e. g., among animals, as some were found to be good for food and others not; so among herbs, as to size, form, color, use for food and medicine, poisonous qualities, etc.; so among woods, as some were better adapted than others to use as instruments of war and of the chase. Men must also, very early in their development, have noticed the changes that took place in the heavens: the sun by day, the moon and the stars by night; have grouped the stars into little clusters here and there as they seemed rudely to resemble forms of things which they knew, and as some were brighter than the rest; have begun to reckon periods of time according as position of sun and moon varied. In their observation of the heavens no other phenomenon would have attracted as much attention as an eclipse, and for a long time men would have ascribed this occasional phenomenon to the intervention of some supernatural power. In process of time, however, as their observations were made with more care and recorded, some regularity would be noticed in these, as in other phenomena of the skies; and the period of their recurrence being at last approximately known by those more learned than the rest, predictions of eclipses would be made and verified by what would seem to the multitude direct supernatural aid. Hence the earliest scientific records that have come down to us are of eclipses observed, and in time regularly predicted, by the Chaldeans; hence also the reputation that was always given to the Chaldeans of having magical power. Coming down now to the time when men first seemed to have a genuine spirit of scientific inquiry, we find it among the Greeks some five hundred years B. C. Whatever of rudely scientific work had been done before, seems to have been for practical or religious purposes. About that time, however, men began to investigate and speculate in order to find out the truth, and soon we see a class of men, known as philosophers, whose one aim was to find out, because they loved, the truth. "What they saw excited them to meditate, to conjecture, and to reason; they endeavored to account for natural events, to trace their causes, to reduce them to principles" (Whewell). They set about this, too, in no small, narrow way. They wanted to go right to the bottom of things, of everything at once, and to know the great principles, as they called them, of Nature and of life. That was the reason why the actual scientific results of Greek thought, with all its splendid powers, were so meager. Two things are the necessary conditions of science—facts, and the human power of reasoning. Two processes must be carried out in order to yield any scientific result: facts must be patiently accumulated, and the mind must set its reasoning powers to work on them. It was in the first of these that the Greeks were wanting. They did not realize the need of endless patience in learning the details of Nature's way of working. They wished to take in all of Nature with one tremendous sweep of thought. They did a little investigating and a great deal of reasoning. Occasionally, however, we find an instance of inquiry into the cause of more definite and limited phenomena, which seems much more to suggest the true spirit of physical inquiry. We have one recorded by Herodotus, which is the more remarkable from being so nearly alone. It is in reference to the fact which he had observed about the flooding of the Nile—that it was flooded for one hundred days, beginning with the summer solstice; and that from that time it diminished, and was during the winter months very low. He tells us that he made pressing inquiries about the cause of it from many of the Egyptians, but that he found no satisfaction, and apparently little interest in the matter. Three different theories on the subject that had been propounded by the Greeks he examines in detail and confutes; and finally he states a theory of his own. And yet even in this instance of scientific inquiry he commits the usual fault of the Greeks—he does not pursue far enough the investigation of the facts of the case, and the absence of the facts he tries to make up for by exhaustive arguments on words used in describing the phenomena.

Strange as it may seem at a first glance, it is a very similar trouble that we find with the reasoning of Aristotle. It seems strange, I say, because we are accustomed to associate with Aristotle just those things which would seem to indicate a scientific temper, and to give promise of great results: 1. Extensive accumulation of facts. Many of those works of Aristotle which remain to us are vast treasuries of facts collected from almost every field of Nature, and we have reason for thinking that he made other wonderful collections of facts which have not come down to us. His work has been a standing marvel to all time. 2. Extraordinary powers of reasoning. 3. The fact that he asserted in the strongest terms the need of building up the whole superstructure of knowledge on *experience.* And yet throughout his works, side by side with the evidences of profound knowledge and profound speculation, there are repeated instances of reasonings which are not only unsound, but altogether puerile—e. g., in the beginning of his treatise on the heavens he proves the world to be perfect by reasoning of the following kind: "The bodies of which the world is composed are solids, and therefore have three dimensions. Now, three is the most perfect number; it is the first of numbers, for of one we do not speak as a number; of two we say both; but three is the first number of which we say all; moreover, it has a beginning, a middle, and an end." That is a fair instance of his scientific incompetency. He has the facts, he is able to reason, but he does not reason *according to* the facts; he loses sight of them and builds up great arguments on words and names. To give one more example: "He is endeavoring to explain the fact that when the sun's light passes through a hole, whatever be the form of the hole, the bright image, if formed at any considerable distance from the hole, is circular. This, of course, is easily seen to be a necessary consequence of the circular figure of the sun, if we conceive light to be diffused from the luminary by means of straight rays proceeding from every point. But Aristotle attempts to explain the fact by saying that the sun's light has a circular nature which it always tends to manifest. He employs the vague and loose conception of a circular *quality* instead of the distinct conception of rays" (Whewell).

It is a kind of reasoning which may be applied with great show of success to everything, but which really proves nothing.

And so, as a matter of fact, Aristotle did not leave one single scientific generalization of value to succeeding ages.

Did not the Greeks then do anything in the way of physical science that was to stand? Yes, there was a little work that was exact, and therefore lasting. Archimedes established the fundamental principle on the one hand of the lever, on the other of pressure in fluids—that is to say, laid the stable foundation of the sciences of statics and hydrostatics. Euclid developed, if he did not discover, the law of the reflection of light. Pythagoras discovered, and his followers developed, some of the fundamental principles of harmonics. Greater than any of the others in genuine scientific work was Hipparchus, who, with many erroneous theories, yet really laid the permanent foundation of the science of astronomy. Only one more name need be mentioned among the ancients—that of Ptolemy, who seemed possessed of a genuinely scientific spirit. He accomplished little original work, made no broad generalization (what is known as the Ptolemaic system was in reality the system of Hipparchus), but more than any other of the ancients he is the type of the true scientist in these respects—the accuracy of his observations, the thoroughness of his work at every point, and the really great additions that he made to science in the way of verifying, correcting, and extending the theory he received. He lived in the early part of the second century A. D.

And the next name to attract our notice is that of Copernicus, more than twelve hundred years later. What is the meaning of that lapse of time? After such noble foundations had been laid, was there no great scientific work built thereon in all those centuries? Absolutely none. It will be well for us to think for a moment of what were the reasons for that barrenness, for the same causes are more or less at work at all times to hinder the growth of science and the extension of scientific method.

1. And what strikes us most forcibly at the outset is a lack of the sense of the importance of physical science. Through most of

that period Christianity dominated the best thought of Europe, and the tremendous practical problems that confronted the Church for a long time threw everything else into the shade; for a long time, I said, during the early part of this period in especial, when the Church in general seemed to realize its responsibility to win the whole world to its Master, and every individual coming into the Church was made to feel that the Church's work was above everything else in the world. The importance of an exhaustive knowledge of the facts of Nature seemed trifling when compared with questions of character and future life, and making the world feel the power of Christ. Eusebius only expressed the thought of much of his age when he said, speaking of those who pursued the study of physical science, "It is not through ignorance of the things admired by them, but through contempt of their useless labor, that we think little of these matters, turning our souls to the exercise of better things." And with that deliberate turning away from such subjects there would come of necessity that indistinctness of ideas about natural things which is fatal to all scientific investigation. Witness these words of Lactantius: "To search for the causes of natural things; to inquire whether the sun be as large as he seems; whether the moon is convex or concave; whether the stars are fixed in the sky or float freely in the air; of what size and of what material are the heavens, whether they be at rest or in motion; what is the magnitude of the earth, on what foundations it is suspended and balanced—to dispute and conjecture on such matters is just as if we chose to discuss what we think of a city in a remote country, of which we never heard but the name." As Whewell, from whom these last two quotations are taken, says, "It is impossible to express more forcibly that absence of any definite notions on physical subjects which led to this tone of thought."

2. Contributing, without doubt, largely to that indistinctness of ideas, and to the low value put upon physical science, was the mysticism common to the early and the mediæval Church, and to the world at large for many hundred years—the mysticism, that is to say, the habit of assigning supernatural agencies to the various phenomena of Nature, and of regarding them as subject to the vicissitudes of arbitrary will rather than as following out the workings of a consistent orderly plan. There is no need of any attempt to show how fatal such a spirit is to science, nor how that spirit seemed for a long while to dominate the world. "It changed physical science to magic; astronomy to astrology; the study of the composition of bodies to alchemy; and even mathematics was changed till it became the contemplation of the spiritual relations of number and figure." That the Church was not, as has been often charged, re-

sponsible for this spiritualizing temper of the age is apparent to any one familiar with the development of Greek philosophy and with the history of the superstitions of the Roman Empire. Nevertheless, it is also true that that temper has been increased in the past and is fostered to-day by the undue emphasis which the Church has placed upon the miraculous character of early Christianity.

3. We notice in the history of the thought of this period, both in the Church and in the world at large, a disposition rather to examine, criticise, and comment upon the work of others, than to do investigating and thinking of one's own. That such a spirit should be found in the Church is not to be wondered at, for the authority of Christ and his apostles would seem to leave no room for originality of thinking on religious subjects, and the sacred Scriptures would give abundant scope for the exercise of the highest learning and of intellectual penetration in interpreting. But the same tendency is noticed outside of the Church, as the great schools of interpreters of Aristotle and of Plato, and the large volumes of abstracts and compilations from preceding writers, bear witness. But when vast learning and ability are expended, rather on such labors than on investigation into the secrets of Nature, science does not thrive.

4. And once again we observe the gradually increasing dogmatic tendency of the Church, the claim to be the repository of all knowledge, the stifling of thought, and of investigation into what might lead men away from the truth and the "faith once delivered to the saints."

It seemed best to give in detail these four evident reasons for the barrenness of science during those centuries, because, as I said, the same things to-day, though with decreasing force, interfere with the progress of science and the extension of scientific method. I shall refer to them again a little further on.

The great revival of four centuries ago in art, in learning, in religion, reached also to science. At last the spell of ignorance, of unreasoning prejudice, of offensive dogmatism, and of vague mysticism, that had held the world for so long, was broken. The new life of science was feeble at first, and remained long in its swaddling clothes. It was about the middle of the sixteenth century that Copernicus gave his great work to the world; then no great work again for nearly one hundred years, when Kepler, Galileo, and Stevinus arise. But the century has not been an idle one. Everywhere men have been awakening to the new light, have begun to think freely and fearlessly; are no longer deterred by the cry of magic or the prohibition of church dignitaries from investigating into Nature for themselves. And so, when in the seventeenth century those mighty ones appeared, thoughtful people in great numbers were found to welcome the new truths; and at almost the same time Descartes by his essay on Scientific Method, and Bacon by the Novum Organum, were able to give an impetus to scientific investigation such as the world had never felt before.

The history of the progress of science from that time to this is too complex to receive any treatment in a paper of this character. How it has been throughout a record of successive triumphs; how gradually one department after another of Nature's workings has been mastered and reduced to orderly system; how all systems have been themselves reduced to one, harmonious and complete, in the magnificent generalization of evolution; how all the time not only has the sum of knowledge been steadily augmented, but the power of acquiring knowledge marvelously enlarged—all of that we know. That which has accomplished such results is science, and the process employed has been scientific method. We are in a position now to have a fairly intelligent idea of it. Look at it and see.

"Scientific method" is not, of course, a technical expression, as are induction, deduction, etc. Yet it means something very definite. It is that method of dealing with phenomena which reason declares and experience has shown to insure the greatest accuracy in results. There are in the complete process four necessary steps: 1. Observation of facts. 2. Comparison and classification, or generalization. 3. Deduction. 4. Verification.

We can see these steps alike in the simplest scientific attempt of our remote ancestors, and in the work of a Newton or a Darwin.

To use an illustration of the former suggested by the book of Leviticus. In very early times it was noticed that animals that had both the characteristics of being cloven-hoofed and of chewing the cud were good for food. A new animal is discovered having those characteristics. It is argued from the general principle laid down that this new animal is good for food, and the matter is verified by experiment. There are the four distinct steps: observation of the facts, drawing a principle from the comparison of the facts, deducing as to the particular case, verifying. The result is, of course, not only a classifying of the particular case, but also the extension of the principle. So with the generalization of the law of gravitation. Numberless facts were observed with the greatest care; from them the principle was generalized; from that again deductions were made as to particular cases; and the results were verified. But though the steps of the process are the same in both instances, yet what a vast difference between them! Take the first step, the observation of facts. All that the thought of the earlier age could do was to note a few striking resemblances and differences among the animals that roamed the neighboring forests. What could be done in the later age, ay, what the scientific temper of the age demanded, was the most rigidly careful examination of multitudes of facts; examination by a trained mind and with all the improved appliances which science and art had given to the world, and then submitted to the searching scrutiny of other trained minds, with like appliances. Or take the last step, verification. In one case it meant finding the effect upon the taste and upon the health. In the other, what it meant may be judged from the account we have of one of Newton's investigations. In applying his hypothesis of gravitation (it was only a hypothesis then) to the motion of the moon, there was a very slight divergence, about two feet a minute, between the time of the revolution of the moon in its orbit, as he calculated it and as he observed it. He was not satisfied until, *eighteen years after*, on account of an improvement made in the method of taking observations, he was able to obtain what he regarded as a verification.

And so what we learn from the history of science is the gradual *development* of scientific method. Scientific method in the work of Hipparchus meant a very different thing from the scientific method of the Chaldeans. Very different still is the scientific method of studying the heavens to-day. So to an even greater degree is there a difference between the scientific method of studying the earth to-day and as our fathers studied it. It is not merely the multitude of facts that we have learned, nor the marvelous instruments that we have made to aid us in our observations; it is also, and by no means least, this—that men all these centuries have been *learning* to observe, to reason, and to verify.

We may say that science and scientific method have grown and developed together: the development of one has invariably advanced the development of the other, and, on the other hand, where one has remained stationary, or has retrograded, so has the other.

History has enabled us to see this other fact also: that the conditions which interfered with the growth of science in the past not only interfere with it always, wherever they exist, but to very much the same degree interfere with the free application of scientific method. What those conditions were during one long period of history we saw—a failure to realize its importance as compared with questions of conduct; a tendency to comment rather than investigate; a tendency to ascribe everything to spiritual agency rather than to natural causes; and lastly, dogmatism. We very well know how, as a matter of fact, those very conditions do interfere with the application of scientific method to-day.

How far is scientific method applicable to the investigation of the Bible? Is there any department of human knowledge to which scientific method of investigation is not applicable? If scientific method is what we defined it to be, that method of dealing with phenomena which reason declares and experience has shown to insure the greatest accuracy in results, then there is obviously no department of knowledge to which that method is not applicable, for it means simply the method which will bring us nearest to the truth. When we are dealing with the highest spiritual verities we use that method which will bring us nearest to the truth; we are bound to use it in the interest of truth! That does not mean that we are to look for material causes for spiritual phenomena; nor does it mean that those things which in their nature appeal to the sensibilities, or have to do with conduct, or require an exercise of faith, must, in order for us to find out the truth, be removed from the domain of sensibility, conduct, faith. That would be a most unscientific method of investigation. The very first canon of scientific method is that it be appropriate to the matter in hand. And so in investigating the truths which are distinctly taught in the Bible—truths which are of the nature of a revelation of God's will and which are designed to reach and affect the whole nature of man—to take no account of other faculties in a man besides his power of apprehending intellectually, and of reasoning logically, would be unscientific beyond hope of pardon.

But what I wish especially to consider is a different kind of investigation of the Bible—one not concerned with the truths taught in the Bible, but with the Bible itself, as a collection of writings that has come down to us from the past. What is the nature of these writings? Who are their authors? Are there any of them which have more than one author? Are there any which are compilations from several different sources? What is the age in which these works were written or compiled? All of those, and similar questions, are not only the appropriate but the necessary inquiries of a truth-loving mind. They will continue to be asked until they are satisfactorily answered. With reference to other writings, the persistence of such inquiries will depend, except in cases of pure curiosity, upon the importance of such writings to the world. On that principle there will be no cessation of inquiries concerning the Bible until they are, as I said, satisfactorily answered, for no other writings are to be compared, in their importance to the world, with the writings of the Bible. How can such answers be given? Where does competency to give answer lie? Does it lie in the authority of the Church? Not to lay any stress upon the fact, one way or the other, that the Church, except in certain localities, has never declared on the canon of the Bible, much less on the questions proposed above, there is no such authority residing in the Church, unless we grant the claim sometimes made for her, to infallibility. With those making such a claim we must, within the limits of this paper, decline to argue.

But if not the Church, what other authority can give us the answers we seek? The authority of primitive tradition, or of the opinions of great commentators, or of the great mass of Christian people of modern times? Authority which is so shadowy in other things that might be mentioned would surely count for nothing in a matter as grave as this. Or can particular expressions of the Bible itself be taken to settle the matter once for all? But as to most of those very questions the Bible itself is silent; and if it had spoken, yet the question of competent authority would only be put one step further back. Or, once again, can the answer come from "the spirit which is in man," guided by God's Spirit? But in this, as in the instance mentioned above, that which has been shown to be incompetent in so many other things can not be called competent in this.

There is, there can be, according to the requirement of our minds, only one answer which will satisfy; it is that which is determined by purely scientific method—that is to say, according to the nature of the subject, that method of investigating literary works which reason declares and experience has shown to insure the greatest accuracy in results. That method is known by the name of the "Higher Criticism."

What is the history of the higher criticism? One would imagine, from the language often used by the opponents of its application to the Bible, that it was an arbitrary method of criticism, invented in these rationalizing times expressly for the purpose of doing away with the divine character of the Bible. But higher criticism has been in use in examining the classics and other (nonscriptural) writings of former ages for fully two hundred years. The first one to state its fundamental principles was Du Pin, in his New History of Ecclesiastical Writers, published in 1694. In 1699 Bentley published his famous examination of the epistles of Phalaris, according to the methods and principles of the higher criticism. There is no better instance of scientific investigation as to authenticity. These epistles had been commonly accepted by scholars as the work of Phalaris, and accounted of great value. Bentley, by his searching examination of them, proved them to be the forgery of a sophist, so conclusively that no scholar worthy of the name has ventured to question the result since. That, I say, was in 1699.

The first work in the way of higher criticism of the Bible, Eichhorn's Introduction to the Old Testament, was not published till nearly one hundred years later.

But that very modernness of the work brings it with some into disfavor. "If that is the true way of investigating the biblical writings," they say, "why are we so long in finding it out? Why did not the fathers of the Church—mighty, indeed, as many of them were, with keenness of insight into the Bible, with profound knowledge of its characteristics, with substantially the same evidence before them as we have now—why did not they give us the principles of the higher criticism, if those principles are true?"

For the very same reason as science in general has not until very lately begun to do its true work. How meager is all the scientific work done in the ages of the past in comparison with that done during the last three hundred years! Men were not up to it; they were only learning the scientific method. So, the scientific method of examining literature, men have not learned till within the past two hundred years. Having all the facts before them which we have now would avail nothing without the knowledge of *how* to observe, to classify, to deduce, to verify, any more in the field of letters than in the field of Nature; any more in the Bible than in other literary works. Among the immense benefits which science has conferred upon the world, surely this should not be accounted the least, that it has taught us a method by which we may find out with ever-growing certainty the truth concerning the Bible itself.

What, then, should be the attitude of lovers of truth toward the higher criticism of the Bible? It can be only one—openness of mind to the ready acceptance of its work. Not that all its present results are to be accepted as final, for its work is still confessedly incomplete. Moreover, we can not fail to see that all investigations into the sacred Scriptures have not been prompted by a genuine love of truth, nor carried on with that judicial mind that should characterize every one working in the name of science. So that not all that has been done in the name of the higher criticism has been according to scientific method. Nevertheless, there are results already obtained, bearing the stamp of truth—such as the composite character of the Hexateuch; the double authorship of Isaiah; the post-exilic date of many of the Psalms—results which to a scientific mind have the practical certainty of a demonstration, but which the great majority of Christian ministers, who are supposed to look at such things intelligently, are not ready to accept.

Are not the ministry in general more zealous to do as St. Paul says, "Hold fast that which is good," than either to do, as he also says, "Prove all things," or to make sure that what they hold fast is the best? Well, undoubtedly that is the better way to do, if they are to do only one—to "hold fast that which is good." And yet it is a blessed thought that every brave, fearless effort which men make toward finding out the truth, with every help that they can get from reason and a knowledge of the past, is an effort after God.

GEOLOGY OF THE KLONDIKE GOLD FIELDS.*

By ANGELO HEILPRIN,
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THE gold fields of the Klondike or Troandik district, as officially designated, lie along or immediately about the waters, whether direct or tributary, of the Klondike, an eastern affluent of the Yukon, which discharges into the "father of northern waters" at the site of Dawson. The Klondike itself, whose upper waters are as yet only imperfectly known, seemingly carries but little gold, the main quantity of the precious metal and that which has made the region famous being contributed by one of its southern arms, the Bonanza, and by a tributary of this, the Eldorado. Hunker Creek, draining a mountainous district several miles to the eastward of the Bonanza, and like it a southern affluent of the Klondike, finds promise of a wealth but little if at all inferior to that of the Bonanza. In a broader or more popular sense, the Klondike region not only embraces the special district so designated in the books of the Gold Commissioner, but also the entire tract which heads up to the sources of the streams that have before been mentioned, and thereby, with Quartz, Sulphur, and Dominion Creeks as tributaries of Indian River, takes in the greater portion of the Indian River mining district, and with Baker, Reindeer, and other creeks on the west, the official districts indicated by these names as well. With this limitation the region roughly defines an area about forty miles square, whose northern boundary lies somewhat to the north of the sixty-fourth parallel of latitude, and on the west reaches to within about thirty-five miles of the international boundary, the one hundred and forty-first meridian of west longitude.

This area of approximately fifteen hundred square miles, which but little exceeds that of Rhode Island or of the county of Cornwall in England, may be broadly characterized as being gently moun-

* From Alaska and the Klondike. With thirty-five full-page illustrations and three maps. By Prof. Angelo Heilprin. New York: D. Appleton and Company. Pp. 326. Price, $1.75.

tainous, with elevations of five hundred to fifteen hundred feet, and in the highest parts of about twenty-two hundred feet. Its lowest depression is the valley of the Yukon, which, in itself occupying a position about fourteen hundred feet above the sea, gives to these points absolute elevations of three and nearly four thousand feet. Dome Mountain, or, as it is frequently designated, simply "The Dome," and less often "Solomon's Dome," "King Dome," and "Mount Ophir," appears to be the culminating point of the entire region; and its prominent position at the water parting of Bonanza, Hunker, Sulphur, and Dominion Creeks makes it a noble figure in the landscape, and the most interesting single feature to the prospector and miner. No absolute determinations for altitude have as yet been made for it, but when crossing the summit it seemed to me that it could not be much under four thousand feet, and I believe that Mr. Ogilvie gives to it about thirty-five hundred feet. The landscape which this mountain dominates is surpassingly beautiful, and I know of no finer view from similarly low mountains than that which this one commands. The sharply incised wooded valleys of the different streams that head up to it tear the mountain into projecting buttresses, and in the ridge that leads off from it southwestward contracts it to the extent of forming for half a mile or more a narrow backbone or saddle. In this respect it reminded me much of Mount Katahdin, in Maine. On a clear day the distant main mass of the snow-capped Rocky Mountains is sharply outlined against the northeastern sky, a most impressive setting to the verdant slopes that trend off toward it, only to disappear in the belt of plain that separates the two mountain systems. I was unfortunate in not getting the full benefit of this view, as at the time of my first crossing the atmosphere was very cloudy, and on the second it was so surcharged with smoke from forest fires in the valleys of Gold Bottom, Quartz, and Sulphur Creeks that hardly more than the foreground was visible.

A succession of five or six knobs runs out from the ridge to which reference has been made and which trends off in the direction of the head waters of Eldorado, and these, together with the main Dome, are sometimes spoken of as the "Seven Domes," but they have no particular significance in the orographic detail and can not even be said to be clearly defined to the eye. Dome Mountain is held in a respect bordering almost on veneration by the Klondikers, inasmuch as it is generally thought to be the mainspring of the gold supply which is contained in the streams that fall off from it, and this means nearly all the good and the promising streams of the entire region. And, in truth, there is for the moment no way of absolutely disposing of the miner's suppositions, nor can the circumstance that little or no gold has yet been found in place either on or in the mountain be given much value in the discussion of the probable origin of the gold, inasmuch as the same negative condi-

A Bit of Norway in Alaska.—Cascade near Skaguay.

tion confronts us in a study of the rocks of all other parts of the same and adjoining regions. Assuming that alluvial gold is in the main a derivative from reef gold, it is certainly strange that streams flowing in well-nigh opposite directions, and yet rising within very short distances of one another, should be so largely charged with gold, unless they have obtained it from a common source; nor can the fact, as received and reported by most miners, but of the full import of which I have not yet fully made up my mind, that the different streams carry different classes of gold, be argued away as having no significance in this connection. Claim holders profess at most times to be able to distinguish between Eldorado gold and that of Bonanza, between the gold of Bonanza and that of Hunker or Dominion, and so on; and there is no question that marked differences in color and in the contours of the coarse flakes and nuggets do present themselves, and even in narrower limits than has here been outlined. Thus, the gold from French Hill, abreast of Claim 17 on Eldorado, has a distinctiveness that is largely its own, and hardly follows the gold of the rest of the Eldorado tract; and the same is true of the gold of Skookum Hill in its relations to that of Bonanza, and also of that of Victoria Gulch. Moreover, the recent assays that have been made by the Bank of British North America and the Canadian Bank of Commerce, in Dawson, of the gold of the different creeks and gulches show plainly that marked differences as to fineness are distinctive qualities—at least they appear to be such at the present time. Thus, while Eldorado and Bonanza gold generally assays but about $15.50 or $15.80 to the ounce, Dominion gold shows as high as $17.80, and Hunker close to $18.50; the gold of Bear Creek, a minor tributary of the Klondike, is reported to actually give $19.20 to the ounce, falling only behind the almost pure specimens that have been reported from American Creek and Mynook, and to which a valuation of nearly $20 has been given. If these assumed facts continue to be proved true, then they must argue in favor of a distribution of gold from largely localized spots or areas, a conclusion that is also pointed to by a number of other circumstances. On the other hand, there are some facts which point in quite the opposite direction, and some of these will be referred to later on.

None of the mountains of the region even approximates the snow line, which would here probably occupy a position not much below six thousand feet, and on the northern face perhaps even rise to seven thousand feet. Not a vestige of snow was seen by me when crossing the Dome, not even in the most sheltered hollows, a condition that at first strikes one as strange, considering that in so many parts of our own mountains of equal or less elevation snow may be found lingering through a long period of the summer months. But here the greatly protracted hours of summer daylight and heat, together with the correspondingly diminished period of night, when a regelation might take place or melting at least could be arrested, have a marked influence in dissipating the winter's snows and ice when these are not particularly heavy. I did not find the August heat quite so intense on the mountain tops as I had been led to

The Vale of Eldorado.

suppose that it would be, but there was quite enough of it to satisfy an ample vegetation and to make heavy garments in walking more than a luxury. Unfortunately, my thermometer was away from me at this time, and as sensation in this dry northern climate is so difficult to gauge by the standard of the mercurial index, I shall not hazard a guess as to the actual reading.

Taking the mountains in their entirety, it is difficult from single points of view to determine for them any definite relation. There are so many valleys in close proximity to one another, some very ancient and others relatively modern, and with trends so opposed in all directions, that in the absence of a dominant ridge or mass this relation becomes very confused; and I was not in a position, with the limited time at my command and the deficiency of rock outcrops, to positively define any main line or axis of uplifts. Yet I suspect that there is one such, with a generally east and west bearing, whose trend might correspond with that of the ridge already referred to, which, with a southwesterly deflection, unites Dome Mountain with the mass that separates the upper Eldorado from Chief Gulch. What strikes one as particularly interesting in the conformation of some of these mountains when seen from an elevation is their hummocky appearance. This is particularly noticeable in the mountains which close in the Eldorado and Bonanza Valleys. With considerable actual elevations, they convey the impression of being merely swells or undulations of an open surface, very much like magnified morainic knolls in a glaciated country. This depressed type of mountain structure, with the evidence of its expanded valleys and gently flowing contours, carries with it the proof of long-continued degradation, and of a history whose pages read far back into geological chronology.

With the evidences of antiquity before us, there are yet indications, amounting, it seems to me, almost to proof, that many of the more pronounced features of the region date their origin from only a comparatively recent period. Such is the case with a number of valleys that are tributary to the main ones, and even the latter appear to have been modified by late stream displacements. Taking the Eldorado or Bonanza, with their open U-shaped troughs and in most parts gently sloping banks, as types of the older valleys, it is surprising to note how many of their tributaries have the deeply incised and narrow contours; and I am led almost to conclude that some of these are really of very late construction. The stream displacements, which, by reason of the indices they give to the finding of new placers, are now beginning to be so attentively studied by the miner and prospector, are emphatic in their testimony in this direction.* One has but to note the triangular area that is included

* Prof. Israel Russell has made the interesting observation that orographic movement may now be taking place in the region of the middle Yukon, about the Lower Ramparts, with the uplifting of a mountain range athwart the river; on this supposition he seeks an explanation for the detail of the Yukon lowlands.

between French Gulch (tributary to Eldorado abreast of Claims 17 and 18) and Adams Creek (tributary to Bonanza at Claim 6 below Discovery) to be convinced of the actuality of recent transformations. Most of the miners regard the high-level gravels of this tract—of French Hill, Gold Hill (opposite to Grand Forks Village), Skookum Hill, and Adams Hill—so rich in gold as to make the claims fairly the rivals of the creek claims, as representing the ancient high-level flow of the Eldorado and Bonanza, but I am convinced that this is not the case (although it is certain that both streams mentioned did at one time flow at as high, and even considerably higher, levels). The materials that so largely distinguish these bench or hillside gravels (placers) are in greater part rounded bowlders or cobbles of white quartz, with a marked deficiency of the fragmented schists and slates which make pay dirt and bed rock in the course of the streams below.

Per contra, the creek claims of Eldorado and Bonanza contain, as a rule, only an insignificant quantity of the rounded quartz bowlders, while almost everywhere where excavations have been made the body and substance of the output are the flattened and discoid parts of the mother-rock of most of the region—quartzitic, micaceous, hornblendic, and chloritic schists, and with them a less quantity of gneissic and dioritic rock. The high quartz-capped knob to which reference has already been made as marking the water parting of French, Nine Mile, and Adams Creeks, has large quartz masses entering into its composition, whether as bosses, dikes, or veins, and to them, or rather their wasted parts, must we look for the source which has so generously supplied the materials of the French-Adams Hills benches. There has been a bad break-up in this quarter, and the materials resulting from it have been swept into the confluence (delta) of the two streams which define the main valleys. Furthermore, the descending arcuate contour lines which are so well marked by terrace slopes on that face of French Hill which is turned to the corner of Eldorado and French Gulch, show plainly the receding course, in the direction of south, of French Creek (Gulch). On the hill slopes south of the position which it now occupies there is none of that deposit which lies to the north of it; the riches of French Hill are delimited by French Gulch, and even in the gulch itself there is nothing that can be compared with what is found on the heights. Again, on the side of Eldorado opposite to French and Gold Hills there is the same deficiency as regards the characteristic bench deposits, and this also holds true with the Bonanza opposite Skookum and Adams Hills. If these high-level deposits were in fact the ancient waste of the Eldorado and Bonanza, we should naturally expect to find at least "outliers" on the less favored bank of the streams, and surely in the case of the Eldorado former evidence of this deposition ought to be had on the

Grand Forks Village.—Valley of the Bonanza.

hillsides, similarly contoured to those of the north, which lie south of and immediately adjoining French Gulch.

Through virtually the entire Klondike tract and far beyond it on all sides there are evidences of high water flows. No more perfect presentation of high-level terraces can be had than that which defines the first line of heights, of perhaps one hundred and fifty to two hundred feet, which so beautifully impress the landscape of the Yukon about Dawson. The observer, from a still loftier elevation, notes these flat-topped banks, having the regularity of railroad constructions, following the course of the river as far as the eye can reach, here perhaps interrupted by a too steeply washed buttress, elsewhere washed to low level by some stream which has taken a transverse direction. A somewhat higher line of benches curves around the still higher points of eminence, and defines the course of water across country—such, at least, it is to-day. And all the way to the top, scattered evidences of the recent presence of water can still be found. I met with rolled or water-worn pebbles so near to the top (the actual summit and not the position of the signal flag) of the high peak overlooking Dawson that it may safely be assumed that they also occur on the very apex (about eleven hundred feet above the present level of the Yukon), a conclusion which is more than strengthened by the finding of pebbles at even a greater elevation on the French-Adams Creek knob. While thus presenting the evidence of high water levels, I am far from convinced that this evidence points exclusively to river flows. Much more does it appear that, in one part of its history at least, we are dealing with the evidences of the past existence of large lakelike bodies of water, perhaps even of a vast inland sea. The contours of the country in a sort of ill-defined way suggest this interpretation—an interpretation that is not, however, without evidence to support it, and which seems also to have been entertained before me by McConnell and by Israel Russell. The latter investigator has, indeed, given the name of Lake Yukon to a former extensive body of water, of which the existing Lakes Lebarge, Marsh, Tagish, and Bennett, with the connecting Yukon, are only dissociated parts. This lake is assumed to have been about one hundred and fifty miles in length, with a surface elevated between twenty-five hundred and twenty-seven hundred feet above the sea.

First in the line of evidence may perhaps be taken the universality of wash gravel and of terrace *débris* and the great heights which they occupy. While I have not myself observed such evidences of water action on the very summit of the Dome, there is reason to believe that they do or at least did exist. Most of this summit, in its narrowed form and rapidly descending slopes, has been, if one may use the expression, more than washed off, and could hardly be expected to retain for any great length of time accumulations of loose fragmental material. But at least its far-off continuation near the source (right fork) of Eldorado Creek bears some of it on its shoulder, and I have also seen it in an excavation on the loftily located Claim 71 of that stream. Nearly abreast of the international boundary, the one hundred and forty-first meridian of west longitude (Greenwich), McConnell and Russell noted the terrace line of the Yukon River as high up as seven hundred and thirty feet, which is still about four hundred feet below the point where I obtained wash gravel on the peak back of Dawson; but Dr. George Dawson found the terraces on Dease Lake to rise to thirty-six hundred and sixty feet, and elsewhere he calls attention to having come across water-rolled gravel at an elevation of forty-three hundred feet, which would probably exceed by about six hundred feet the culminating point of Dome Mountain. Such high water could, with the existing configuration of the land surface, hardly define any other feature than that of a large interior sea or of a series of lake basins; and while it may be argued that there has been sufficient degradation of the land surface since the period of the height of water to permit us to reconstruct a contour that would be in harmony with altered and reduced river courses, and relieve us from the necessity of invoking the assistance of lacustrine bodies in a solution of the problem, it does not seem to me likely that this has been the case. The physiognomy of the upper Yukon Valley supports this contention, and even to-day the river has not yet fully escaped from a lacustrine condition which is merely fragmental of a previous state.

On one point bearing upon the succession of events in the upper Yukon Valley, and which has its connection with the history of the Klondike region, my conclusions differ somewhat from those that have been expressed by Dawson. This pertains to the deposit of volcanic ash which is so marked a feature of the accumulations of the river's banks. For nearly three hundred miles by the course of the river a stratum of pumiceous ash, ordinarily not more than four or six inches in thickness, constitutes almost without break the top layer but one of the banks on either side, and that which is above it is generally only the insignificant soil or subsoil which immediately supports the vegetation. So persistent is this ash layer, and so uniformly does it hold to an even thickness and to its exact position beneath the surface, that without further examination one would be tempted to believe from a little distance that it was merely the ordinary subsoil layer from which the color had been leached out by vegetable growths. Here and there, where there have been local disturbances or water washings have produced concentration, it may have acquired a development of a few feet, and occasionally it has accommodated itself to flexures or saggings of the deposits which it normally caps as a horizontal zone. Dr. Dawson, in commenting upon its occurrence, correctly assumes that it represents one continuous volcanic eruption, the date of which might fall well within a period of a few hundred years, and he speculates as to its being possibly associated with an outbreak from Mount Wrangel or some active cone which is represented by the Indians to exist in the region of the upper White River. Beyond this, from the normality of its position, and the assumed fact that no fluviatile or aqueous deposits have been found overlying it, the same observer argues that the outbreak must have taken place subsequent to the formation of the present river courses and their valleys, a conclusion in which I do not see my way to concur. The only satisfactory interpretation of this vast uniformly placed and uniformly layered deposit of ash is to me that which assumes a deposition in a widely extended lake basin, or in shallow lagoon waters which already in part occupied the present valley surfaces. In such waters precipitation from long-continued suspension would proceed gradually and evenly, to the end of shaping a deposit of nearly uniform development and of vast extent. Such depositions we find in the valleys lying north of the City of Mexico (Zumpango, Tequixquiac) and in the lacustrine area of Anahuac, also in the famous fossiliferous basin of Florissant, in Colorado. With the subsequent formation or reformation of the river's course we should have this deposit cut through, with the result of presenting the even layer which is so persistent in its following. This method would also account for the anomalous position in which we find the ash deposits; while still holding the same relation to the top surface, it occasionally rises far above what might be assumed to be its normal height or level above the water's surface—from four to ten feet—a condition that would hardly be in consonance with the assumption that the ash was deposited after the actual river channels had been cut. But other and more direct proof of aqueous occupation after the laying of the ash is had in the fact that in one place at least, and doubtless many more such will be found on closer investigation, lacustrine or fluviatile shells (subfossils) occur in the layer overlying the ash. A locality of this kind is found on the right bank not many miles above the Five Finger Rapids. Here, at a height of not more than four feet above the river, I had the pleasure of determining species of *Limnea* and *Physa*, associated singularly enough with *Helix*, in the layers immediately above and below the ash bed, and in both horizons the species were identical. This isolated fact speaks volumes for itself. Had this been the region of Helena, Ark., I should have been prompted to class the bed with a portion of the Mississippi loess. What interested me further in this connection was the fact that up to this time I had failed to bring to light one solitary mollusk from the upper Yukon, and to all inquiries regarding the existence of shellfish in this northern water invariably a negative reply was received. Only on that day did I again obtain success

SLUICING ON THE BONANZA.

in my malacological effort, the almost icy waters rewarding my search with a single specimen—unfortunately subsequently lost—of a *Bythinella*, or some closely related type, so that even to-day my knowledge does not permit me to state if the subfossil species of the banks have their living representatives, either specific or generic, in the almost wholly noncalcareous waters of the existing river. The question from more points than one is interesting, and deserves more than passing attention. It may be remarked in this place that the only other fluviatile invertebrate which I found in these waters was a white siliceous coating sponge, whose statoblasts were well visible to the naked eye. Unfortunately, the loss of my specimens has prevented determination, a circumstance the more to be deplored as these fresh-water sponges are the most northern in habit known to the zoölogist.*

There is evidence of another kind pointing to a comparative newness of much of the present course of the Yukon. The feature has been noticed alike by nongeographers and geographers, and by geologists as well, that the arm which carries the greatest volume of water does not everywhere occupy the main orographic valley. Thus, as Dawson has well pointed out, in coming up the stream the valley of the Big Salmon appears to be more nearly the continuation of the main valley below than that which still (and properly) continues to be designated the Lewes (Yukon) above; and this is still more markedly the case with the Hootalinqua (Teslin-too or Newberry River) at the confluence with the Thirty Mile. Even the valley of the Pelly at its junction with the Yukon, near Fort Selkirk, would perhaps to most persons suggest itself as the main channel of erosion. There is no hardship to geological facts in invoking the aid of great displacements to account for a condition which to my mind is well impressed upon the landscape; for, even without the proper or fully satisfactory evidence in hand to support the view, I fully believe that the greater part of the upper Yukon tract only recently emerged from a lacustrine condition. Nor is it to me by any means certain that this emergence or final reconstruction of the land surface into valley tracts need be more than a few hundred years old, or necessarily older than the deposition of the volcanic ash, which is hypothetically carried back to Dawson to a possible five hundred years or so. If it should be objected that we know of no such rapid change in the configuration of a land surface brought about by aqueous agencies, it might be answered that the mechanics of erosion in a pre-eminently drift-covered region, under subarctic conditions and with the influence of a most powerful and energetic stream near by, have neither been studied nor observed.

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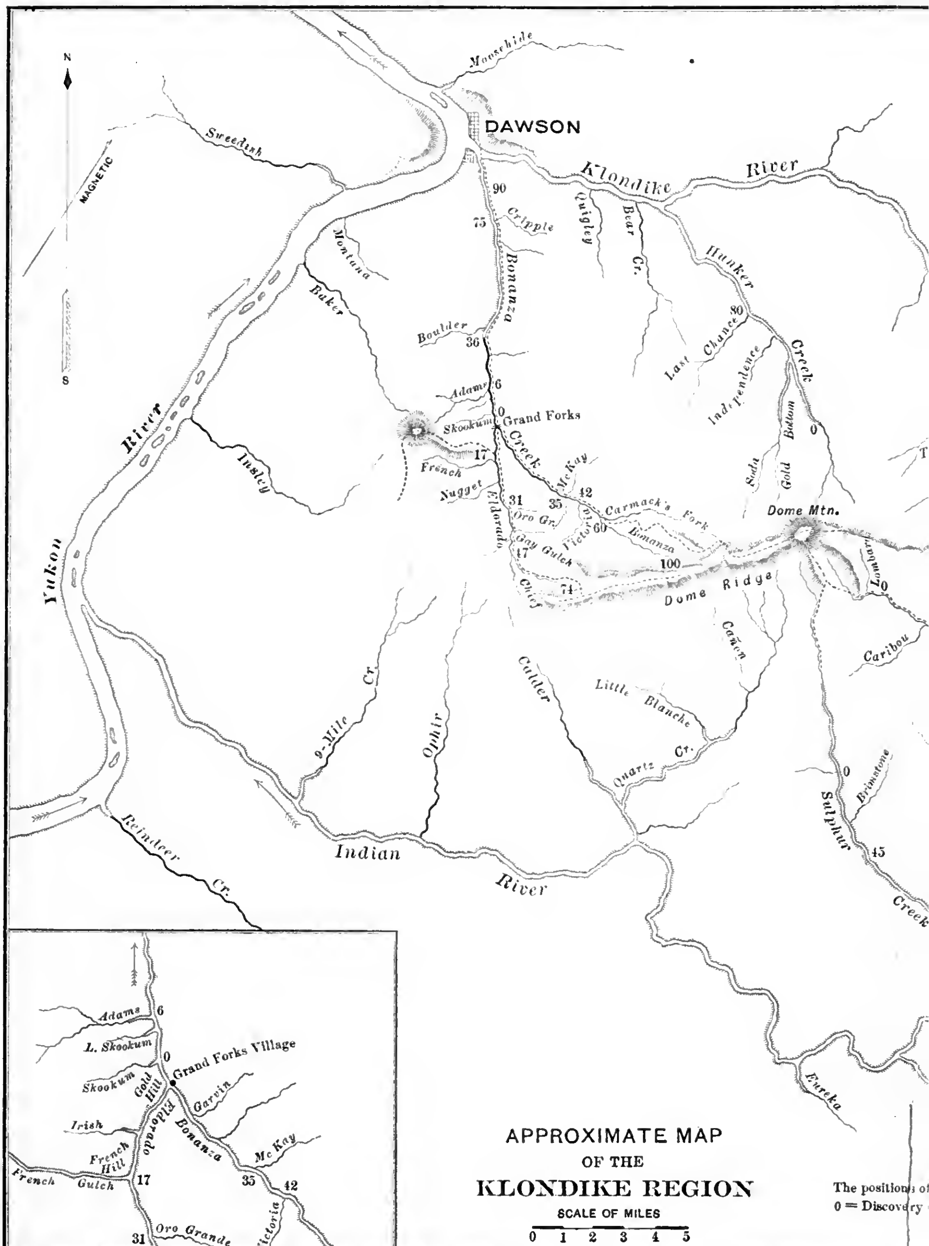
* Professor Russell, in discussing the flood-plain deposits of the Yukon about the mouth of the Porcupine River, says that "fresh-water shells were frequently observed in the finer deposits." Unfortunately, no statement is made of the types which they represent.

Let us examine the possibilities of the case. As an initiatory premise it might be assumed, without much chance of either affirmation or denial, that the degradation of the land surface in the immediate valleys of the main streams is or has been in the past taking place at the rate of half a line per day; so far as the eye and ordinary instruments of measurement are concerned this is a quite inappreciable amount, and I see no reason why it may not be assumed as the working power of the Yukon. With this rate of erosion a valley trough or contour of about a foot and a third might be formed in the period of a single year, or of nearly seven hundred feet in five hundred years; and if we lessen the daily erosion to one quarter of the amount stated—i. e., to an eighth of a line—we should still have in this same period of five hundred years, speaking broadly, a trough of about one hundred and seventy-five feet depth, quite sufficient to have brought about most marked changes in the aspect of a drift-covered lagoon region, and perhaps ample to account for those physiognomic peculiarities which have been discovered. I am fully impressed with the magnitude of the distance which separates the amount of erosion which I have assumed—an eighth of a line daily—from the "one foot in six thousand years," which has been preached categorically from lecturn and text-book for the better part of a quarter of a century and threatens to make dogma for still another period of equal length; but the conditions here are entirely different from those of average continental denudation—in fact, have as nearly nothing in common as they can have. My observations in the tropics and subtropics have most impressively taught me the lesson of rapid changes, and with the conditions that are and have been associated with the Yukon, I am prepared for the lesson of equal change in the north. But, as a matter of fact, are we not taught of a removal in the west central United States of some twelve thousand feet of rock strata in a period not impossibly considerably less than two hundred thousand years? The one foot in sixteen years has here likewise nothing in common with the "prevailing" rate of continental destruction.

While stalled on a bar on the Yukon River, about two miles above Fort Selkirk, I was much impressed with the mechanical work of the stream. The gravel and pebbles were being hurried along rapidly under the lash of a five to six mile current, and their groans were audible frequently when they themselves were invisible. Every few minutes our steamer would swerve from her seemingly fixed position by the undercutting of the bar, and perhaps it would be not far from the truth in saying that we should be to-day in very nearly the same position that we were in then had it not been for this undermining action of the stream. Let it be remembered that the Yukon has a current ranging up to seven miles, or to eight, as some of the navigators say, and that in certain months it is swiftly ice-bound both on top and at the bottom, and heavily charged with bowlders, and one may well realize the work of which it is capable. That with which I have debited it is purely hypothetical or conjectural, but it may serve a purpose in the elucidation of the main problem.

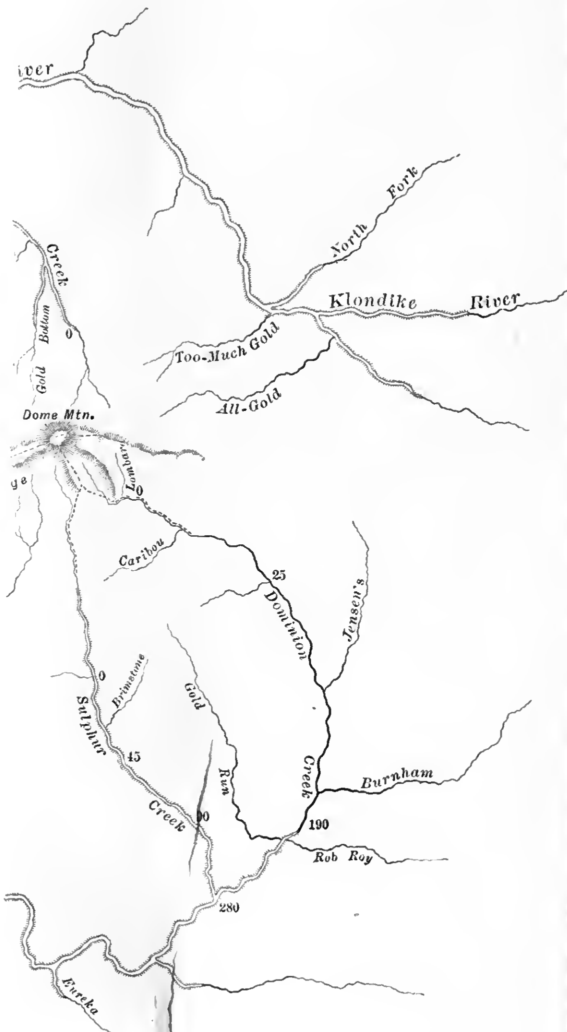
In its more distinctively geological relations the Klondike region may be broadly defined as one composed in the main of schists and schistose rocks, defining an area of considerable disturbance. Owing to the limited number of outcrops, by far the greater part of the surface being still buried beneath vegetation of one kind or another, the variety of rocks included within the region can best be told from an examination of creek bowlders or the different dumps that mark hundreds of diggings and prospect holes along the various valleys and gulches. Some of this output, in which may be found fragments of quartz and quartzitic schist, of mica, hornblende, and chloritic schists and slates, of granitic gneiss and gneissose granite, porphyry, diabase, diorite, and quartz (quartzite), is probably extra-territorial, having been washed in at a time when a more extensive foreign water had access to the region; but there is enough of outcrop to show that most, and perhaps all, of the types here indicated are really a part of the tract. The schists and schistose rocks, whose age from direct evidence in the field I was unable to determine, but which are almost certainly the equivalents in greater part of the Birch Creek series, as described by Spurr from the American side (Birch Creek and Forty Mile districts), constitute the kernel of the region. Observation is as yet too limited to permit of a positive classification of these schists according to their natural relations, and the reasons that have prompted some to consider them as being in part of pre-Paleozoic age are not quite clear to me, although they may easily be such. Of granite and true gneiss in position I saw practically nothing, and the limestones and marble were not sufficient in quantity to permit me to identify the heavy beds which are considered to be the distinguishing element of the Forty Mile series. The beds where exposed show in most parts steep dips—in places standing almost vertically—but in how far these dips are uniform or the reverse, or in any way define a line of strike with anticlinals and synclinals, must be left for future close examination to ascertain.

Great lumps of white or pinkish quartz, some of them *in situ*, others washed or rolled down the open slopes, occur at many points of some of the mountain elevations, indicating the presence of dikes



APPROXIMATE MAP
OF THE
KLONDIKE REGION
SCALE OF MILES
0 1 2 3 4 5

The positions of
0 = Discovery



The positions of some of the Creek claims are indicated by their numbers.
0 = Discovery claims

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and gash veins, and in part of interstratified beds containing this material. I found much of it at several "horizons" of the slope back of French Hill, and also as a cap overlying the badly cleaved and fragmented schists of the summit (three thousand feet?) of the prominent knob which dominates this region. The same type of "kidney" quartz appears at repeated intervals on the slope leading up to the Dome, almost immediately after leaving the junction of Carmack's Fork with the Bonanza, and also on the saddle ridge which might properly be considered to be a part of the summit of Dome Mountain. Prospectors have in nearly all cases staked these assumed outcrops of quartz, recognizing them as ledges, and in a number of them have claimed the discovery of the "mother lode." So far as visible gold is concerned, I have in nearly all cases found them to be absolutely barren, and I do not think at this time that there is much chance of finding anything materially valuable in them, although events might prove the reverse. Most of the quartz that has so far been discovered in direct association with the gold—that is to say, wrapped up with or within itself, as in the case of the quartz-gold nuggets of French Hill—is of a gray-blue or pinkish tint and of a granular and nonspathic type, therefore differing materially in aspect and structure from the quartz of the hillsides and from the greater number of the quartz bowlders that are contained in the dumps or have been removed from bed rock. Some of the bowlders or rolled pebbles containing coarse gold are of the same character of quartz as the quartz of the hillsides. Notably one such was shown to me as coming from a high-bench claim (Millett's) on Adams Hill (left "limit" [bank] of Bonanza, between Little Skookum and Adams Creek), and other similar fragments taken from the rock *in situ* were observed on Gay Gulch and the ridge which separates the head waters of this stream from those of Eldorado. In a dump at the mouth of Gay Gulch (a right-hand tributary of Eldorado abreast of Claim 37) I found fragments of rotted quartz which were well sprinkled with fine gold.

It does not by any means appear so conclusive to me as seemingly it does to Professor Spurr that because in some gulches the gold heads up in increasing quantities the nearer we aproach the beginnings (heads) of these gulches, and that with this approach the coarseness of the grains and nuggets likewise increases, we are necessarily forced to assume that the travel of the gold at large has been confined within the boundaries of the gulches in which it is at present contained, or that its source is to be sought near by. A number of the most "solid" streams of the Klondike region, such as the Bonanza and Eldorado, if we are permitted to judge from the evidence of outputs and of prospects up to the present time, hardly sustain the conditions of the American creeks. The richest claims on the Eldorado are, starting from its mouth—the junction of the Bonanza—4, 5, 12, 13, 29, 30, 31, 36, with other claims abundantly rich between these. Number 30 is, I believe, generally considered to be the banner claim, and it is situated about three miles up—far enough, perhaps, to sustain in a superficial way Professor Spurr's generalization as to location—and above it 36 is not unlikely to show up as well as any of the other creek claims below. But the valley of Eldorado, whether constricted or open, continues for miles beyond either of its two head forks—that which is known as Eldorado proper, and the one, Chief, or Chief Isaac Gulch, which is geographically the continuation. So little has been found above 36 or 37 that the stream in that part is ordinarily spoken of as being barren. Again, so far as the tributaries on either side of Eldorado are concerned, and the possibility that they are responsible for the gold that is contained in the main stream between 37 and 1 rather than the Eldorado itself—a condition in no way impossible or improbable—it can only be said for them that up to this time they have, with the possible exception of Oro Grande (tributary to Eldorado abreast of Claim 31), yielded very little gold themselves, and have hardly given indication of containing much of a supply. I have used the words "up to this time" advisedly, because I am aware upon how little the evil reputation of a gulch rests, and how prospectors deceive themselves by the character of their defective prospect holes. Hence, while my argument is drawn from existing evidence, it can not be assumed that this evidence is by any means sufficient to warrant a conclusion. It is by no means unlikely that some of the lateral gulches will really be found to be largely gold-bearing, and of such Gay Gulch and the left-fork ascending of Eldorado (Eldorado proper above 47) appear to me the most promising.*

The condition of the Bonanza is very similar to that of the Eldorado. Its greatest wealth, as so far determined, is concentrated in its middle course, beginning about five miles above its mouth and terminating some six miles below its source. But very little gold, if the information given to me is correct, has been taken out from or determined to exist in the tract lying above Claim 42 above Discovery, or the mouth of Victoria Gulch (left-hand tributary, whose source is found on a ridge from the opposite side of which Gay Gulch descends to the Eldorado), and yet the valley continues open and without material change for at least two miles, and with a certain contraction for four miles more. Barring the Eldorado and the streams coming in from the same side nearest to it—Big Skoo-

* Since writing the above intelligence has been received of the location of a rich pay streak on Gay Gulch.

kum, Little Skookum, and Adams—few if any of the side gulches of the Bonanza are known to be really rich in gold, and for the moment, at least, they can hardly be looked upon as having furnished the main supply to the main stream.

THE RACE PROBLEM IN THE UNITED STATES.

By BOOKER T. WASHINGTON,
PRINCIPAL OF THE TUSKEGEE NORMAL INSTITUTE.

I HAVE been asked a number of times during the last few months the cause of and the cure for the riots that have taken place recently in North Carolina and South Carolina. I am not at all sure that what I shall say will answer these questions in a satisfactory way, nor shall I attempt to narrow my expressions to a mere recital of what has taken place in these two States. I prefer to discuss the problem in a broader manner.

In the first place, in politics I am a Republican, but have always refrained from activity in party measures, and expect to pursue this policy in the future; so in this article I shall refrain, as I always have done, from entering upon any discussion of mere party politics, in the narrow and usual sense. What I shall say of politics will bear upon the race problem and the civilization of the South in the larger sense. In no case would I permit my political relations to stand in the way of my speaking and acting in the manner that I believe is going to be for the permanent interest of my race and the whole South, regardless of mere party name and organization.

In 1873 the negro in the South had reached the point of greatest activity and influence in public life, so far as the mere holding of elective office was concerned. From this date those who have kept up with the history of the South have noticed that the negro has steadily lost in the number of elective offices held. In saying this I do not mean that the negro has gone backward in the real and more fundamental things of life. On the contrary, he has gone forward faster than has been true of any other race in history, under anything like similar circumstances.

If we can answer the question as to why the negro has lost ground in the matter of holding elective office in the South, perhaps we shall find that our reply will prove to be our answer also as to the cause of the recent riots in North Carolina and South Carolina. Before beginning a discussion of the question I have asked, I wish to say that this change in the political influence of the negro has continued from year to year, notwithstanding the fact that for a long time he was protected politically, by force of Federal arms and the most rigid Federal laws, and still more effectively, perhaps, by the voice and influence in the halls of legislation of such advocates of the rights of the negro race as Charles Sumner, Benjamin F. Butler, James A. Garfield, Oliver P. Morton, Carl Schurz, and Roscoe Conkling; and on the stump and through the public press by those great and powerful negroes, Frederick Douglass, John M. Langston, Blanche K. Bruce, John R. Lynch, P. B. S. Pinchback, Robert Browne Elliot, and many others; but the negro has continued for twenty years to have fewer representatives in the State and national legislatures. The reduction has continued until now it is to the point where, with few exceptions, he is without representatives in the lawmaking bodies of the State and of the nation.

Now, let us find, if we can, a cause for this. The negro is fond of saying that his present condition is due to the fact that the State and Federal courts have not sustained the laws passed for the protection of the rights of his people, but I think we shall have to go deeper than this, because I believe that all agree that court decisions, as a rule, represent the public opinion of the community or nation creating and sustaining the court.

At the beginning of his freedom, it was unfortunate that those of the white race who won the political confidence of the negro were not, with few exceptions, men of such high character as would lead them to assist him in laying a firm foundation for his development. Their main purpose appears to have been, for selfish ends in too many instances, merely to control his vote. The history of the reconstruction era will show that this was unfortunate for all the parties in interest.

It would have been better, from any point of view, if the native Southern white man had taken the negro, at the beginning of his freedom, into his political confidence, and exercised an influence and control over him before his political affections were alienated. In the light of present experience, I think all will now agree that the ballot would have meant more to the negro and would have been more lasting in its results, would have caused less opposition, if it had been given to him gradually, as he came into possession of education.

The average Southern white man has the idea to-day that if the negro were permitted to get any political power all the mistakes of the reconstruction period would be repeated. He forgets or ignores the fact that thirty years of acquiring education and property and character have produced a higher type of black man than existed thirty years ago.

But to be more specific for all practical purposes, there are two political parties in the South—a black man's party and a white man's party. In saying this, I do not mean that all white men are Democrats, for there are some white men in the South of the highest character who are Republicans, and there are a few negroes in the South of the highest character who are Democrats. It is the general understanding that all white men are Democrats, or the equivalent, and that all black men are Republicans. So long as the color line is the dividing line in politics, so long will there be trouble.

The white man feels that he owns most of the property, furnishes the negro most of his employment, that he pays most of the taxes, and, besides, has had years of experience in government. There is no mistaking the fact that the feeling which, in some way, has heretofore taken possession of the negro—that to be manly and stand by his race he must oppose the Southern white man with his vote—has had much to do with intensifying the opposition to him.

The Southern white man says that it is unreasonable for the negro to come to him, in a large measure, for his clothes, board, shelter, and education, and for his politics to go to men a thousand miles away. The Southern white man argues that when the negro votes he should in a larger measure try to consult the interests of his employer, just as the Pennsylvania employee tries to vote for the interests of his employer.

The Southern white man argues, further, that much of the education which has been given the negro has been defective in not preparing him to love labor and to earn his living at some special industry, and has, in too many cases, resulted in tempting him to live by his wits as a political creature, or by trusting to his " influence " as a political timeserver.

Then there is no mistaking the fact that much opposition to the negro in politics is due to the circumstance that the Southern white man has not got accustomed to seeing the negro exercise political power, either as a voter or as an officeholder. Again, we want to bear it in mind that the South has not yet reached the point where there is that strict regard for the enforcement of the law against either black or white men that there is in many of our Northern and Western States. This laxity in the enforcement of the laws in general, and especially of criminal laws, makes such outbreaks as those in North Carolina and South Carolina of easy occurrence.

Then there is one other consideration which must not be overlooked: it is the common opinion of almost every black man and almost every white man that nearly everybody who has had anything to do with the making of laws bearing upon the protection of the negro's vote has proceeded on the theory that all the black men for all time are going to vote the Republican ticket, and that all the white men in the South are going to vote the Democratic ticket; in a word, all seemed to have taken it for granted that the two races are always going to oppose each other in their voting.

In all the foregoing statements I have not attempted to define my own views or position, but simply to describe conditions as I have observed them, that might throw light upon the cause of our political troubles.

As to my own position in all these matters I do not favor the negro's giving up anything which is fundamental and which has been guaranteed to him by the Constitution of the United States. It is not best for him to relinquish any of his rights; nor would his doing so be best for the Southern white man. Every law placed in the Constitution of the United States was placed there to encourage and stimulate the highest citizenship. If the negro is not stimulated and encouraged by just State and national laws to become the highest type of citizen, the result will be worse for the Southern white man than for the negro. Take the State of South Carolina, for example, where nearly two thirds of the population are negroes. Unless these negroes are encouraged by just election laws to become taxpayers and intelligent producers, the white people of South Carolina will have an eternal millstone about their necks.

In addressing the Southern white people at the opening of the Atlanta Exposition, in 1895, I said:

"There is no escape through law of man or God from the inevitable:

"'The laws of changeless justice bind
Oppressor with oppressed;
And close as sin and suffering joined
We march to fate abreast.'

"Nearly sixteen millions of hands will aid you in pulling the load upward, or they will pull against you the load downward. We shall constitute one third and more of the ignorance and crime of the South, or one third of its intelligence and progress; we shall contribute one third to the business and industrial property of the South, or we shall prove a veritable body of death, stagnating, depressing, retarding every effort to advance the body politic."

Subsequently, in an open letter to the State Constitutional Convention of Louisiana, I wrote:

"I am no politician; on the other hand, I have always advised my race to give attention to acquiring property, intelligence, and character, as the necessary basis of good citizenship, rather than to mere political agitation. But the question upon which I write is out of the region of ordinary politics: it affects the civilization of two races, not for to-day alone, but for a very long time to come; it is up in the region of duty of man to man, of Christian to Christian.

"Since the war no State has had such an opportunity to settle for all time the race question, so far as it concerns politics, as is now given to Louisiana. Will your convention set an example to the world in this respect? Will Louisiana take such high and just grounds in respect to the negro that no one can doubt that the South is as good a friend to the negro as he possesses elsewhere? In all this, gentlemen of the convention, I am not pleading for the negro alone, but for the morals, the higher life of the white man as well; for the more I study this question, the more I am convinced that it is not so much a question as to what the white man will do with the negro as to what the negro will do with the white man's civilization.

"The negro agrees with you that it is necessary to the salvation of the South that restriction be put upon the ballot. I know that you have two serious problems before you: ignorant and corrupt government on the one hand, and on the other a way to restrict the ballot, so that control will be in the hands of the intelligent, without regard to race. With the sincerest sympathy with you in your efforts to find a good way out of the difficulty, I want to suggest that no State in the South can make a law that will provide an opportunity or temptation for an ignorant white man to vote and withhold the opportunity or temptation for an ignorant colored man without injuring both men. No State can make a law that can thus be executed without dwarfing for all time the morals of the white man in the South. Any law controlling the ballot that is not absolutely just and fair to both races will work more permanent injury to the whites than to the blacks.

"The negro does not object to an educational and property test, but let the law be so clear that no one clothed with State authority will be tempted to perjure and degrade himself by putting one interpretation upon it for the white man and another for the black man. Study the history of the South, and you will find that where there has been the most dishonesty in the matter of voting, there you will find to-day the lowest moral condition of both races. First, there was the temptation to act wrongly with the negro's ballot. From this it was an easy step to act dishonestly with the white man's ballot, to the carrying of concealed weapons, to the murder of a negro, and then to the murder of a white man, and then to lynching. I entreat you not to pass a law that will prove an eternal millstone about the necks of your children.

"No man can have respect for the Government and officers of the law when he knows, deep down in his heart, that the exercise of the franchise is tainted with fraud.

"The road that the South has been compelled to travel during the last thirty years has been strewn with thorns and thistles. It has been as one groping through the long darkness into the light. The time is not far distant when the world will begin to appreciate the real character of the burden that was imposed upon the South when four million ex-slaves, ignorant and impoverished, were given the franchise. No people has ever been given such a problem to solve. History has blazed no path through the wilderness that could be followed. For thirty years we have wandered in the wilderness. We are now beginning to get out. But there is only one road out, and all makeshifts, expedients, profit-and-loss calculations, but lead into swamps, quicksands, quagmires, and jungles. There is a highway that will lead both races out into the pure, beautiful sunshine, where there will be nothing to hide and nothing to explain, where both races can grow strong and true and useful in every fiber of their being. I believe that your convention will find this highway; that it will enact a fundamental law that will be absolutely just and fair to white and black alike.

"I beg of you, further, that in the degree that you close the ballot box against the ignorant you open the schoolhouse. More than one half of the population of your State are negroes. No State can long prosper when a large part of its citizenship is in ignorance and poverty, and has no interest in government. I beg of you that you do not treat us as an alien people. We are not aliens. You know us; you know that we have cleared your forests, tilled your fields, nursed your children, and protected your families. There is an attachment between us that few understand. While I do not presume to be able to advise you, yet it is in my heart to say that if your convention would do something that would prevent for all time strained relations between the two races, and would permanently settle the matter of political relations in one Southern State, at least, let the very best educational opportunities be provided for both races; and add to this an election law that shall be incapable of unjust discrimination, at the same time providing that in proportion as the ignorant secure education, property, and character, they will be given the right of citizenship. Any other course will take from one half your citizens interest in the State, and hope and ambition to become intelligent producers and taxpayers, to become useful and virtuous citizens. Any other course will tie the white citizens of Louisiana to a body of death.

"The negroes are not unmindful of the fact that the white people of your State pay the greater portion of the school taxes, and that the poverty of the State prevents it from doing all that it desires for public education; yet I believe that you will agree with me that ignorance is more costly to the State than education; that it will cost Louisiana more not to educate the negroes than it will to educate them. In connection with a generous provision for public schools, I believe that nothing will so help my own people in your State as provision at some institution for the highest academic and normal training in connection with thorough training in agriculture, mechanics, and domestic economy. The fact is that ninety per cent of our people depend upon the common occupations for their living, and outside of the cities eighty-five per cent rely upon agriculture for support. Notwithstanding this, our people have been educated for the most part since the war in everything else but the very thing most of them live by. First-class training in agriculture, horticulture, dairying, stock raising, the mechanical arts, and domestic economy would make us intelligent producers, and not only help us to contribute our proportion as taxpayers, but would result in retaining much money in the State that now goes outside for that which can be as well produced at home. An institution which will give this training of the hand, along with the highest mental culture, would soon convince our people that their salvation is largely in the ownership of property and in industrial and business development, rather than in mere political agitation.

"The highest test of the civilization of any race is in its willingness to extend a helping hand to the less fortunate. A race, like an individual, lifts itself up by lifting others up. Surely no people ever had a greater chance to exhibit the highest Christian fortitude and magnanimity than is now presented to the people of Louisiana. It requires little wisdom or statesmanship to repress, to crush out, to retard the hopes and aspirations of a people, but the highest and most profound statesmanship is shown in guiding and stimulating a people, so that every fiber in the body and soul shall be made to contribute in the highest degree to the usefulness and ability of the State. It is along this line that I pray God the thoughts and activities of your convention be guided."

As to the cure for such outbreaks as have recently hurt North Carolina and South Carolina, I would say that the remedy will not come by the Southern white man's being merely cursed by the Northern white man or by the negro. Again, it will not come by the Southern white man merely depriving the negro of his rights and privileges. Both of these methods are but superficial, irritating, and must in the nature of things be short-lived. The statesman, to cure an evil, resorts to enlightenment, to stimulation; the politician to repression. I have just remarked that I favor the giving up of nothing that is guaranteed to us by the Constitution of the United States, or that is fundamental to our citizenship. While I hold to these views as strongly as any one, I differ with some as to the method of securing the permanent and peaceful enjoyment of all the privileges guaranteed to us by our fundamental law.

In finding a remedy, we must recognize the world-wide fact that the negro must be led to see and feel that he must make every effort possible in every way possible to secure the friendship, the confidence, the co-operation of his white neighbor in the South. To do this, it is not necessary for the negro to become a truckler or a trimmer. The Southern white man has no respect for a negro who does not act from principle. In some way the Southern white man must be led to see that it is to his interest to turn his attention more and more to the making of laws that will in the truest sense elevate the negro. At the present moment, in many cases, when one attempts to get the negro to co-operate with the Southern white man, he asks the question, "Can the people who force me to ride in a Jim Crow car, and pay first-class fare, be my best friends?" In answering such questions, the Southern white man as well as the negro has a duty to perform.

In the exercise of his political rights I should advise the negro to be temperate and modest, and more and more to do his own thinking, rather than to be led or driven by a political "boss" or by political demagogues.

I believe the permanent cure for our present evils will come though a property and educational test for voting that shall apply honestly and fairly to both races. This will cut off the large mass of ignorant voters of both races that is now proving so demoralizing a factor in the politics of the Southern States.

But most of all it will come through industrial development of the negro! It is for this reason that I have believed in General Armstrong's theory of industrial education. In the first place, industrial education makes an intelligent producer of the negro, who becomes of immediate value to the community rather than one who yields to the temptation to live merely by politics or other parasitical employments. In the next place, industrial development will make the negro soon become a property-holder, and when a citizen becomes a holder of property he becomes a conservative and thoughtful voter. He is going to think about the measures and individuals to be voted for. In proportion as the negro increases his property interests he becomes important as a taxpayer. When the negro becomes a large taxpayer, he will see that it is to his interest to consult with his white neighbor about the measures to be voted for.

There is little trouble between the negro and the white man as to matters of education, and when it comes to the negro's business development the black man has implicit faith in the advice of the Southern white man. When the negro gets into trouble in the courts, which require a bond to be given, in nine cases out of ten he goes to a Southern white man for advice and assistance. Every one who has lived in the South knows that in many of the church troubles among the colored people the ministers and other church officers apply to the nearest white minister for assistance and instruction. As soon as we have grown to the point where we shall consult the Southern white man about our politics as we now consult him about our business, legal, and religious matters, there will be a change for the better in the situation.

The object lesson of a thousand negroes in every county in the South owning neat and comfortable homes, possessing skill, industry, and thrift, with money in the bank, who are large taxpayers and co-operate with the white men in the South in every manly way for the development of their own communities and counties, will go a long way in a few years toward changing the present status of the negro as a citizen as well as the attitude of the whites toward the blacks.

In proportion as the negro grows along industrial and business lines he will divide in his politics on economic issues, just as the white man in other parts of the country now divides his vote.

In proportion as the South grows in business prosperity the whole South will divide its vote on economic issues, just as other portions of the country divide their vote. When we can enact laws that result in honestly cutting off the large ignorant and nontaxpaying vote, and when we can bring both races to the point where they will co-operate with each other in politics in matters of business, religion, and education, the problem will be in a large measure solved, and political outbreaks will cease.

COLONEL GEORGE EARL CHURCH, speaking of the Indians of the country of the Amazons, relates of the chief of a horde of Yocaré savages whom he met among the falls of the Madeira, a young fellow twenty-five years old, that "he appeared to know everything that was going on around him. He seemed to have eyes in the back of his head, so acute were his senses. His hearing appeared to indicate, and his mind to define, the thousand things which were occurring in the tropical forest around us. Instinctively, he classified and estimated them at their true value as if they were under close and accurate analysis. As he sat dining with me at my camp table, in the simplicity of his nature and modesty of his nakedness, I could not help thinking that, in the evolution of man, many magnificent qualities have been sacrificed upon the altar of civilization."

THE ANTIQUITY OF MAN IN NORTH AMERICA.

By Dr. CHARLES C. ABBOTT.

THE claim of satisfactory evidence of the extreme antiquity of man in the valley of the Delaware River has been soberly discussed and intemperately ridiculed until the public, both scientific and general, have become tired of hearing the subject mentioned; but this is no valid reason why the truth should not be ascertained. If man in a paleolithic stage of culture did exist on the Atlantic seaboard of North America, then we have a basis upon which to build—a tangible starting point from which to date a history of human activities on this continent. As it is, we have but an immense array of facts, largely unrelated, and the greater portion sadly distorted and misleading because of the reckless theories set forth with them by their discoverers, and undoubtedly there never has been, in the whole range of scientific agitation of a simple question, as great a volume of reckless assertion, illogical deduction, and disregard of exact statement. The main question was often wholly lost sight of, and the author's sole purpose that of demonstrating some one else in error. Predetermination on the part of many has been fatal to the value of their field work. Convinced on theoretical grounds, such are necessarily blinded when on the spot where positive evidence occurs. He who does not desire the object searched for seldom finds it; and, later in the day, pride declines to accede to the just demands of candor—the admission of having reached a wrong conclusion.

There probably would not have been as much attention paid to the subject of man's growth in culture on this continent had not the proposition of a sequence from paleolithic to Indian, with an intervening period, seemed to necessitate a dating back to the Glacial epoch, which naturally brought geological erudition to bear upon the question, and since then, most surprisingly, there has been confusion worse confounded, rather than a flood of light. Much has been written, but we can not yet be confident which author is most nearly correct; and the latest report, showing sad evidences of haste, is vitiated by evident determination to modernize every trace of man, whether the facts warranted such procedure or not.

What is held, primarily, to be an evidence of paleolithic man is a wrought stone implement, that in Europe was characteristic of his handiwork. Here, in the valley of the Delaware, this same form of implement has been confidently asserted to be a rejected piece of stone—usually argillite—that failed to lend itself to reduction to a finished blade or spear point. If this could be established as of invariable application, however the supposed "reject" occurred, then the whole matter would be brought to a quick conclusion. But the "reject" theory has utterly failed of establishment. The typical paleolithic implement is not characteristic of the refuse of an arrow-maker's workshop site, and the familiar arrow points of small size, nor even the long, thin blades of several times their length, were reduced from masses greatly larger than the desired form. The refuse of many a chipping site shows this conclusively; and, as hundreds of failures demonstrate, many an arrowhead was made from a pebble but a trifle larger than the finished object.

But admit, for argument's sake, the identity in shape of a "reject" and a "paleolithic" implement; this does not prove their identity in age and origin, and it is not an unwarranted or illogical suggestion to draw a distinction between the two, where the conditions under which they occur suggest a possibility of diverse history. Rather than demonstrating that all rudely chipped stones are "failures," it should be shown that paleolithic man, as we know of him in Europe, could not possibly have existed here. This has not only never been attempted, but the conditions during and immediately subsequent to the glaciation of the river valley have been asserted, time and again, to have been favorable for man's existence. Furthermore, it has not been shown that a typical paleolithic implement could not have been available on this continent, as it undoubtedly was in Europe, as an effective weapon, and it must be remembered that the fauna of the Delaware Valley was, in glacial times, very like that of parts of Europe in what we may call the reindeer period. Like conditions may not have produced like results in the case of early man, but what was practicable in Europe was certainly so in America, and the question resolves itself into that of determining if any trace of man that has been discovered in the valley of the Delaware can be dated back to a time preceding the Indian as he was when first he came in contact with the European. Did, in other words, the Indian bring his art with him from Europe or Asia, or did he experience a growth in culture from paleolithic simplicity to neolithic complexity?

The whole subject hinges on the distribution of these traces of man. If from the first day of his occupancy until the European replaced the Indian the immediate valley of the river had undergone no change, then the imperishable relics of the first and last savage would remain associated, and position alone would tell nothing concerning any particular object's age or origin, but, at the present day, except the contents of graves, not a stone implement of the Delaware Indians rests where chance or the intention of its one-time owner placed it. Indeed, save a few bowlders of the largest size, few natural objects on the immediate shores of the river are as first seen by William Penn and his associates. This fact has not been duly considered, and unwarranted conclusions have been published as established truths—all, of course, eliminating antiquity from the Indian history of the region. The fact that a so-called paleolithic implement was found lying on the surface of the river's shore has resulted in a pen picture of a modern Indian attempting to fashion a blade and tossing the pebble aside in disgust. Why, indeed, could not an Indian walk on exposed gravel and pick up a pebble as well as we can to-day?

There are two considerations to which we must give heed when this question is asked. We are, in the first place, tacitly informed that the Indian was given to chipping stone in this haphazard way to supply a sudden need upon the spot, all of which is not only not a reasonable assumption, but absolutely incorrect, as argillite bowlders and pebbles, which are not abundant in the gravels, were not habitually used, but, instead, the mineral was systematically mined and selected with skill, so that failures were reduced to a minimum. Then, again, if the object as found has been lying undisturbed on the river shore for centuries—two centuries at least—why is it that the chips are not there also? These are never found under such circumstances. In fact, they are very rarely found at all in the gravel where the implement itself occurs, and in numbers they exceed the "reject" or finished object at least as ten to one. Furthermore, we are asked to believe that the river shore where we find rude implements is the same to-day as when the Indian wandered along it centuries ago. Fig. 1 shows clearly how the never-resting tidal flow wears away the shore, carrying sand and fine gravels from one point and spreading it elsewhere to form a sand bar, it may be, and turning the channel from one side of the stream to the other, and so exposing long reaches of the shore to wasting, that for many a year had been fixed and apparently secure. Often the mud is entirely removed from the underlying gravel, and abundant traces of Indian occupation are brought to light, and, less frequently, so strong a current attacks a given point that even the gravel is moved and deep holes are formed, to be filled in time with the wasting shore from a point perhaps a mile away. This is the story of the river of to-day, and so it has been for centuries; and yet we are asked to believe that we can fill the moccasin prints of the Indian by walking now along the water's edge. I submit that it is asking a great deal too much.

It has been suggested that rudely chipped implements, when found on the gravelly shore of the river, have fallen out from the bank and rolled down from where they had long been lying. This is not at all improbable; but how does this modernize the object, when the gravel extends quite to the surface? The pebbles and bowlders at the top of the bank are clearly as much a part of the deposit as are those at its base, and while the surface may be—is, in fact—less ancient than the deeper gravels, still they can not be dissociated; and it is a significant fact that we find, on the gravel at the foot of the bluff or other exposure, only the rude argillite objects at the water's edge or on the flat laid bare at low tide, and not

Fig. 1.—Wasting River Shore due to Tidal Flow.

a general assortment of the Indian's handiwork, including pottery; and we must not overlook the fact that the "gravel-bed" implements bear evidence of all the conditions to which the gravel itself has been subjected—this one stained by manganese, that incrusted with limonite; this fresh as the day it was chipped, because lost in sand and water and not subsequently exposed to the atmosphere; that buried and unearthed, rolled, scratched, and water-worn until much of its artificiality has disappeared. The history of almost every specimen is written upon it, and not one tells such a story as has been told about it by the advocates of the "Indian-reject" theory.

Much has been written on the natural history of the gravel that is so marked a feature of the river valley, particularly at the head of tide water, and almost every essay differs in more or less degree from its fellows in the matter of the gravel's age as a well-defined deposit. Its origin no one can question, nor the agencies by which it was brought to where we now find it. Ice and water did the work, nor have they ceased entirely to add to the bulk transported in strictly glacial times—perhaps it were better to say in superlatively glacial time, as the river even now can be positively glacial upon occasion, as Fig. 2 demonstrates. The main channel has often been completely blocked with ice and the water forced into new directions and spread over the lowlands or flats, which it denudes of its surface soil, and once within recent years the stream found an old channel, deepened it, and for a time threatened to leave a flourishing riverside town an inland one. Ice accumulated in this way year after year must necessarily affect the river's banks, and yet the extent of "damage" is trifling usually, in comparison with that of the water, particularly when agitated by passing steamboats or violent winds; and now, too, the ice of our present winters does not transport coarse pebbles to any significant extent. I am convinced of this since the examination I gave acres of ice, when the river was gorged with it, some years ago. It was possible to walk for miles over the ice, as shown in Fig. 2, and to see it under exceedingly favorable circumstances, and a most careful search failed to reveal a stone larger than a pigeon's egg incased in this ice, which was all gently floated from far up the stream and stranded here; and where piled up upon the shores it usually remains until melted, and really acts as armor plate, protecting the ground from abrasion when the floods incident to the "break-up" prevail. Such are the present-day considerations, and they have a direct bearing upon the question of man's antiquity here because, first, the river valley has not varied for hundreds of years, except in becoming wider, the low shores receding, and the stream becoming broader and more shallow. In earliest Indian times the river was subject to freshets and ice gorges as now, but never did the water become so dammed up as to overflow the broad plateaus, areas of glacial gravel, that at the close of the Glacial period were within the boundary of the river. The Delaware was a very different stream then—*crescendo* for thousands of years, and *diminuendo* for thousands since—until now it barely hints at what once was. But not even in the height of its glacial activity was the climate so severe that the waters contained no fish, nor the forests of the high surrounding hills harbored no game. Never was it as bleak as the arctic region of to-day, and as man maintains a footing there, why should he not have done so here, where life was ever more easily sustained? True; but did he live here in glacial time?

It has been stated in the most positive manner, which only positive evidence could warrant, that so-called paleolithic implements have not been found *in situ* in gravel deposits at a distance from the river, and such, *if there were such*, as appeared to be in the gravel, were recent intrusions. This statement, in its several parts and its entirety, is absolutely incorrect, and no excuse can be offered for its publication. It is to be explained, however, because avowedly predetermined. Wherever the glacial gravel of the Delaware tide-

Fig. 2.—Ice-Gorged River.
Reproducing on a small scale the conditions of the Glacial epoch.

water region is found, there paleolithic implements occur, as they also do on and in the surface of areas beyond the gravel boundary. We accept, notwithstanding the unscientific source of the suggestion, the statement that post-glacial floods inhumed all traces of man found beneath the superficial soils, and find that, if these traces are considered in that light, some mysterious power was behind the senseless flood, and always buried argillite paleolithic implements far down in the gravel, and then selected argillite artifacts of more specialized forms for the overlying sands and reserved the pottery and jasper arrow points for the vegetation-sustaining soil. This, as stated, is absurd, but such is the order of occurrence of the traces of early man in the upland fields, and these are to be considered carefully before a final conclusion can be reached. The broad, elevated plateau extending eastward from the present bank of the river offers facilities for studying the evidences of man's occupancy in this region such as are to be found in few localities. The principal reason for this is that almost no local disturbance has occurred since the original deposition of the sand that overlies the gravel and underlies the soil. The natural history of these underlying sands has recently received a good deal of attention, because, unlike the deeper gravels, there is perfect accord as to the occurrences therein of artificially chipped objects; and the suggestion that they are of intrusive origin being set aside as untenable, the geologists are now divided on the question whether the sand is wind-blown, a modified dune, and so not necessarily old even in years, or the result of intermitting overflow of water, usually carrying a considerable amount of sand and often heavy with washings from some distant clay bank. The objections to the "eolian" theory are that pebbles and bowlders, even of considerable weight, are scattered at all elevations through the sand, and these pebbles, as a rule, do not present any evidence of exposure to eroding sands, but are smooth and glassy, or the typical water-worn pebbles of a brook or the river bed, and more significant is the fact that the sands themselves are of different degrees of fineness, layer upon layer, and are nowhere clean or free from clay; and finally the thin layers of clay are clearly continuous over such extensive areas that in no sense can they be called segregations of that material. On the other hand, a carefully instituted comparison of the sand from the surface of the field to its junction with the gravel proper shows its identity with a deposit made by water in comparatively recent times. No difference whatever could be detected. The sand dune, modified by rains and finally leveled to a plain, presents, in section, no such appearance as the sands that overlie the gravels of glacial origin. Without a scintilla of reason, however, many geologists declare that no deposit of sand can be of any geological significance *if it contains traces of man not clearly intrusive.* The latter fact necessitates the former claim, all of which, I submit, is nonsense.

Fig. 3 illustrates how artificially chipped pebbles occur in this underlying sand. The upper portion shows the superficial soil removed to its point of contact with the sand. This is determined by the change of color from dark brown to light yellowish brown, and it is generally so very abrupt a change that no doubt arises as to where the soil ends and the sand begins. The sand proper is shown by the position of the object—the measuring rule and trowel. It will be noticed that the implement is lying flat, as such an object would almost necessarily be if transported by water, and not perpendicular, as would be the case if it had fallen down some root-hole, animal's or insect's burrow, or opening in the earth from any cause, and now obliterated.

Fig. 3.—Occurrence of an Argillite Implement in Glacial Stratified Sand.

The presence of these artificial flakes, blades, and other forms of simple implements can only be explained by considering them as a constituent part of the containing bed, having been brought hither by the same agency that brought the sand, pebbles, and clay. When standing before a newly made section of this implement-bearing deposit it is easy to picture the slow progress of its accumulation. The broad plain has been subjected to overflow, now of water bearing only sand, and then of muddy water; now with current strong enough to roll small pebbles from some distant point, and then periods when the sun shone on the new deposit, dried it, and the loose sand was rippled by the wind. Floods of greater volume occasionally swept across the plain, and ice-incased pebbles were dropped upon its surface, and with this building up of the plateau to a higher level there were also brought to it traces of man's handiwork. Of this, I think, there can be no doubt now. Years ago I endeavored to show from the distribution of rude argillite implements of specialized forms, as arrow points and small blades, trimmed flakes and scrapers, that these objects were older, as a class, than jasper and quartz implements and weapons, and that pottery was made only in the rudest way before "flint" chipping—jasper and quartz—was established. The more exhaustively this subject was followed up, the proposition became more evidently true, and to-day it is unqualifiedly confirmed by the results obtained from systematically digging deeply over wide areas of country. The fact that argillite continued in use until the very last does not affect this conclusion.

As the high land, now forty or more feet above the river and beyond the reach of its floods of greatest magnitude, was once continually overflowed and gradually built up by the materials the water spread upon it, it is evident that the conditions were materially different when such things happened from what now obtains, and the whole configuration of the country to-day points to but the one conclusion: that these plateau-building floods occurred so long ago as when the river flowed at a higher level and possessed a greater transporting power than at present. This, it is true, was long after the coarse gravel and huge bowlders were transported from the hillsides of the upper valley, but it was before the river was confined to its present channel, and more significantly before what may be called the soil-making period, itself of long duration and the time of the Indian as such. Not an argillite chip from the sands beneath the soil but speaks of the distant day when this plateau was an almost barren plain, and man saw it, roamed over it, and perhaps dwelt upon it, when but the scantiest vegetation dotted its surface, and only upon the hills beyond its boundary were there trees and herbage.

Even if we consider the agency of the streams that now are but insignificant inflowing brooks in spreading, during their freshet stages, sand over level areas, we must still go back to a time when they were streams of infinitely greater magnitude than they have been for many centuries, and before, too, the Indian was a skilled chipper of jasper and a potter of taste, else why the absence of these products of his skill in the deeper sands? It matters not how we look at it, whether as geologists or archæologists, or whether it is all post-glacial, or the starting point is still so distant as ice-age activities, the sequence of events is unaffected. We still have paleolithicity in the gravel, argillite and the discovery of pottery synchronous with the deposition of the gravel-capping sand, and, lastly, the Indian.

The record is not a difficult one to read, and never has been, and the manifold attempts to modernize all traces of man on the eastern coast of North America can safely be relegated to the limbo of misdirected energy. Studied in the proper spirit and after the needful preliminary study of archæology as a whole, the student will find himself, when in the field—ever a more desirable place than the museum—face to face with evidences of an antiquity that is to be measured by centuries rather than by years.

THE USE OF ACETYLENE.

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IT is now five years since the use of acetylene as an illuminant was suggested to the public, and it may be of interest to give a sketch of what has been done during this time, especially as it seems that with the year 1899 the tentative period which must characterize every new industry is in some respects passed, and a period of solid and well-directed industrial effort, backed by ample capital, has begun. The knowledge gained during this tentative period by the laboratory experiments of scientific men, and by the practical work of inventors and promoters, has made it possible for the industry to enter on its new phase. To understand its present and to foresee its future importance it is necessary briefly to review the work of the last years.

In May, 1892, Mr. Thomas Willson, a Canadian electrician, tried to make the metal calcium in an electric furnace in his works at Spray, North Carolina, by heating a mixture of lime and coal dust. He thought that the lime (calcium oxide) would act on the coal (carbon) to form calcium and carbon monoxide. He did not succeed in getting calcium, but found in the furnace a brown, crystalline mass, which was decomposed by pouring water on it, yielding an inflammable gas. Willson is not a chemist, and he therefore sent specimens of the material to several men of science to determine its nature. It was shown to be calcium carbide, a compound of calcium and carbon, formed by the action of the carbon on the calcium oxide. The reaction expressed in chemical symbols is $CaO + 3C = CaC_2 + CO$. The gas formed by the action of water was acetylene, a compound of carbon and hydrogen. The reaction is $CaC_2 + H_2O = C_2H_2 + CaO$; calcium carbide and water form acetylene and lime. If water enough is added, the lime is slaked, and slaked lime, or calcium hydroxide, $Ca(OH_2)$, is formed. Neither calcium carbide nor acetylene was a new discovery; acetylene was discovered by Edmund Davy in 1836, and its properties were studied by Berthelot in 1862. Impure calcium carbide was first made in 1862 by Wöhler, who described its decomposition by water into acetylene and lime. What was there new, then, in Willson's discovery? Two important facts: (1) He was the first to make carbide by a method applicable commercially; (2) he was the first to make crystalline carbide. Wöhler's carbide was impure and amorphous; Willson's, nearly pure and crystalline, so that he succeeded in obtaining United States patents for crystalline carbide, and, as all carbide made by commercial processes is crystalline, its manufacture is covered by Willson's patents.

In the same year, 1892, Prof. Henri Moissan, of Paris, announced the discovery of crystalline calcium carbide. Moissan's discovery, too, was an accidental one. He was reducing refractory metallic oxides in an electric furnace made of lime. At the close of the article in which he reports his work to the French Academy of Sciences (*Comptes Rendus de l'Académie Française*, vol. cxii, page 6, December 12, 1892) he refers in two lines to the formation of an ill-defined carbide of calcium by the action of the carbon electrodes on the lime of which his furnace was made.

As is common with most important inventions, there is a dispute as to the priority of making carbide by an electric furnace; and the wonder is, not that there is a dispute, but that there are so few claimants. A few words of explanation of the electric furnace will show why. The enormous heat of the electric furnace (2000° to 3000° C.) is caused by an electric arc, formed by currents playing between carbon electrodes; carbon is often used in the furnace processes; here we have one constituent of calcium carbide. Lime, the material for the other constituent, withstands heat better than any other common substance excepting magnesia; naturally, inventors would use it, as Moissan did, as a refractory lining to the furnace. Electric furnaces were not new. The conditions then were such that the discovery of the carbide was fairly forced on experimenters, and, as we have seen, the discoveries of Willson and Moissan were both accidental.

American priority was claimed by Willson, French priority by the friends of Moissan, German priority by Professor Borchers, of Aix-la-Chapelle. Fortunately for Willson, among those to whom he had sent specimens of carbide was Lord Kelvin, the famous English physicist, whose reply to Willson, stating that the substance received was calcium carbide, was dated October 3, 1892, two months before Moissan's first publication. Borchers's claims are too vague to waste space on. Willson's priority is now generally recognized excepting in France. The German Government has acknowledged it, and has annulled the German patent granted to Bullier.

Commercial carbide is essentially an American discovery, and it was developed industrially by Willson's associates before industrial action began abroad. Messrs. Dickerson and Suckert, of New York, were the first to undertake the industrial liquefaction of acetylene. Dr. G. de Chalmot, chemist, and Mr. J. M. Morehead, electrician, worked up the details of the furnace process in the early days at Spray, North Carolina, and the purity and the yield from a given weight of material of their carbide have never been excelled, though cheaper working furnaces are now in use.

Carbides of other metals can be made in the electric furnace, but, owing to the cheapness of the new material, calcium carbide is the only one of these which has industrial value as a source of acetylene. One pound of pure carbide yields 5.89 cubic feet of acetylene.

Thus far carbide has been found industrially valuable for two other purposes. The one is for carbonizing steel; experiments in Germany show that iron or soft steel takes up carbon more readily when it is heated with carbide than when it is heated with coal dust or charcoal. Some steel works are now using carbide for this purpose. The other use of carbide is more important. It is found to be a valuable germicide. It is said to be the most effectual preventive of black rot, and to destroy the *Phylloxera,* the two worst enemies of the grape. The action of the carbide as a germicide depends on its decomposition by the moisture of the soil, forming acetylene, which kills the *Phylloxera.* If the use of carbide on a large scale substantiates the claims made for it, this is a discovery of vast importance. The ravages caused by the *Phylloxera* in the vineyards of southern Europe, of Africa, and Australia must be ranked as great national calamities.

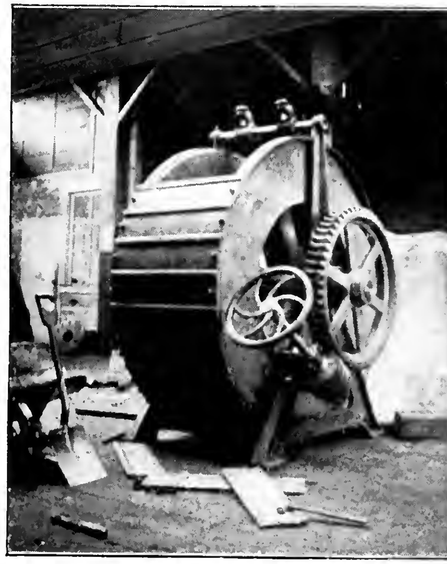
A temperature ranging from 2000° to 2500° C. (3600° to 4500° Fahrenheit) is required to make carbide. It is probable that this temperature can be economically attained only by the electric furnace using water power as the source of the electric current, and this is the only method used for making carbide, with the exception of the

Walther process, which does not use electricity but depends on the intense heat generated by burning acetylene under pressure. In electric furnaces the formation of carbide depends simply on the heat of the arc, which fuses the mixture of lime and coke. The latest improvements on the first very simple forms of furnace have secured continuity of work and economy of electric energy. In the United States carbide is made exclusively in the Horry furnace. This furnace consists of a huge short cylinder or hollow wheel, mounted to revolve slowly on a horizontal shaft. The periphery of the cylinder is closed by removable cast-iron slats. As the cylinder is partly revolved on its axis from time to time, the slats are taken off from one side and replaced on the other, thus leaving the top always open. The cylinder is filled on one side with the powdered mixture of coke and lime. Into the mixture two vertical carbon electrodes project downward through the open top of the cylinder. As the carbide is formed, the cylinder is revolved, lowering the mass from the electrodes. The fused carbide cools, hardens, and is broken off and removed as it rises on the other side of the slowly revolving cylinder; new material is constantly fed in to maintain the level around the electrodes. The process in the Horry furnace is continuous; the furnace can be run without arresting the current until repairs are necessary. It is said to combine the different theoretical improvements referred to, and to reduce the cost of production. The Horry furnace is in use at Niagara Falls and at Sault Ste. Marie. At St. Catherine's, Canada, Willson is using his own furnace. Abroad, the older types of furnace, the Willson, Bullier, and Héroult, are those chiefly in use.

HORRY FURNACE, SHOWING ELECTRODES.

The actual ingot of good commercial carbide is nearly pure—ninety-six to ninety-nine per cent—but the ingot is surrounded by a crust of carbide mixed with unchanged material, containing forty to

NOTE.—We are indebted to the courtesy of the Electrical World and Engineer for cuts showing the Horry furnace.



Horry Furnace, showing Gearing.

seventy per cent of carbide. Foreign makers break and blend ingot and crust to standard size, the best makers guaranteeing their carbide ninety per cent pure, giving five cubic feet of acetylene per pound (pure carbide gives 5.89 cubic feet). Eight to nine pounds of carbide per horse power in twenty-four hours, averaging five cubic feet of acetylene, is considered satisfactory work. The Union Carbide Company, which controls the sale of carbide in the United States, is selling graded carbides under guarantee, the first grade being the nearly pure ingot, the lower grade the crust.

As the moisture of the air decomposes the carbide, it must be broken up as soon as made, and packed in air-tight tin cans, varying in size from one to four hundred pounds.

Horry Furnace,
showing Carbide just removed.

The present price of carbide abroad averages $96.80 in large lots, and $7.26 per hundredweight in small lots, packing included; in the United States, $70 per ton in large lots, and $4.50 per hundredweight in small lots, packing included. In 1898, 4,650 tons are said to have been made in the United States and Canada, and a much larger amount abroad. The output for 1899 is estimated at 12,000 tons for the United States, with a capacity in the new works in erection at Sault Ste. Marie and at Niagara Falls of 41,000 tons. The new works building in Europe, to be finished in 1899–1900, have a capacity for making 80,000 metric tons. These figures will justify the statement made at the beginning of this article, that the new industry has found ample capital.

The statement is still current that acetylene attacks copper and brass, forming an explosive compound. This is not true. Exhaustive experiments by Moissan and by Gerdes, keeping these and other metals in contact with acetylene for months at a time, have shown that the metals were not affected. The conditions under which the explosive copper acetylide is made in laboratories can not well occur in generators or gas holders. It has been said that acetylene is very poisonous; the experiments of many observers, and especially those of Gréhant, do not confirm this statement. Gréhant experimented on dogs, causing them to breathe mixtures of acetylene, air, and oxygen, which always contained 20.8 per cent of oxygen, this being the percentage of oxygen in pure air. By this device he was able to discriminate between the poisoning caused by acetylene and suffocation caused by insufficient oxygen. A mixture containing twenty per cent acetylene inhaled for thirty-five minutes did not seem to trouble the animal. A sample of the dog's arterial blood contained ten per cent of acetylene. A dog which inhaled a mixture containing forty per cent of acetylene died suddenly after fifty-one minutes, having inhaled one hundred and twelve litres of the mixture; the arterial blood contained twenty per cent acetylene. Gréhant proved that acetylene simply dissolves in the blood plasma, while carbon monoxide forms a compound with the hæmoglobin of the blood. A dog breathing a similar mixture of air, oxygen, and illuminating gas containing only one per cent of carbon monoxide quickly showed convulsive movements, and died after ten minutes; its blood contained twenty-four per cent of carbon monoxide. Thus acetylene, while slightly poisonous, is less poisonous than coal gas, and vastly less than water gas, which contains a high percentage of carbon monoxide.

A pressure of thirty-nine atmospheres and three quarters at 20° C. converts acetylene into a liquid weighing one third as much as the same volume of water, while one cubic foot of the liquid when released from pressure gives five hundred cubic feet of gas.

Hitherto acetylene is used only as a source of heat or as a source of light; yet with very cheap carbide it would prove useful in many ways in chemical industry, and its use would have the most widespread effect on industry and agriculture. For instance, a method of making alcohol from acetylene is patented abroad, and by another patented process it is proposed to make sugar from acetylene. With the present prices of alcohol, sugar, and carbide, these processes have no commercial value.

Acetylene may be made from the carbide in gas works and delivered to the consumer through mains like ordinary illuminating gas; or it may be liquefied at a gas works and delivered to the consumer in the liquid form under pressure; or the consumer may purchase carbide and generate acetylene for his own consumption. All three of these methods are in use.

To understand the attitude of insurance companies and of consumers toward liquid acetylene it will be well to examine its record for the last few years. Those interested in methods for liquefying acetylene, and for reducing the pressure of the liquid at the place of consumption so that the consumer actually uses it as a gas under a water pressure of six inches or less, may find processes described in detail in the Progressive Age, and in other technical journals. Suffice it to say that the methods in use in this country and abroad are simple and effective. The purified acetylene is delivered in strong steel cylinders, which may be placed in a special building or case and need not be handled by the consumer. It has been proved by the exhaustive experiments of the eminent French chemist Berthelot that liquefied acetylene in cylinders can not be exploded by blows or shocks to the closed cylinder. If it is exploded, however, by causing a spark within the cylinder, the explosive force is very great, being about equal to that of gun cotton.

The use of the liquefied acetylene is so simple and clean that the attention of inventors was first turned to this mode of supply. It may in future come again into prominence despite the present strong feeling against it, its use in many cities being prohibited. This feeling was caused by a number of explosions, accompanied by loss of life. Three of these explosions occurred in factories for liquefying acetylene; one in a factory where liquid acetylene regulators were made; several in buildings of consumers. In October, 1896, Pictet's works in Paris were wrecked by the explosion of a cylinder filled with liquid acetylene; evidence proved that the cylinder was held in a vise, and that the two workmen killed were at the ends of a wrench, closing or opening the valve, supposing the cylinder to be empty. The explosion was caused either by a spark from friction in turning the screw, or by the too sudden opening of the valve and releasing the pressure, causing a shock sufficient to decompose the liquid. In December, 1896, the works of G. Isaac, in Berlin, were destroyed by an explosion in the condenser where the cooled acetylene was liquefied by pressure; Isaac and three workmen were killed. Evidence showed that through carelessness warm water instead of cold water was in contact with the condenser, thus warming the liquid and increasing the pressure to a point which burst the condenser. In December, 1897, the works of the Dickerson & Suckert Acetylene Gas Liquefying and Distributing Company in Jersey City were destroyed by fire caused by the explosion of a cylinder filled through carelessness of workmen with a mixture of air and liquid acetylene—i. e., with an explosive mixture—killing the superintendent and a workman. In the explosion at the regulator factory at New Haven, January, 1895, the valve of the cylinder, on which one of two workmen killed was working, broke; a large volume of acetylene escaped and ignited from a lighted candle. In all four cases the explosions were caused by ignorance or carelessness incident to the beginnings of a new industry, and could be avoided by experience and skill.

It should be stated that in the explosion at Paris all of the full acetylene cylinders were dug out of the ruins unhurt. The same was true at Berlin, where five full cylinders were blown against the wall of the building by the explosion of the condenser, but did not explode. At Jersey City sixty filled cylinders were exposed to the heat of the fire following the explosion; they were fitted with safety diaphragms of fusible metal; forty-eight remained intact, the acetylene burning off quietly as it escaped through the fused diaphragm, and twelve exploded, either on account of imperfection of the diaphragms or stoppage of the air passage leading from the diaphragm. The explosions of liquid acetylene in buildings of consumers have been due in every case to gross carelessness and ignorance on the part of the consumer.

Although one of the chief points in favor of the liquid acetylene is its portability, yet it can be shown that it is still easier to carry carbide to the consumer. One cubic metre of acetylene is compressed to two litres in liquid form; two litres of carbide weigh 4.44 kilogrammes, which will produce a cubic metre and a third of acetylene, reckoning three hundred litres to the kilogramme, which is the average guaranteed yield of carbide. The light tin carbide cans occupy less space and weigh less than the heavy steel cylinders, while the generation of the gas is simple and, with proper generators, perfectly safe. On the other hand, the generators must be cared for, must often be filled with fresh carbide, and from time to time must be cleaned. With the generator system acetylene is as safe as or safer than illuminating gas. Berthelot has shown that at pressures below two atmospheres a vessel filled with acetylene can not be exploded by the explosion of a cap of fulminating mercury within the vessel, nor by heating a wire which extends into the vessel to a white heat by an electric current. The reason is that the acetylene can not explode unless it is decomposed into its elements, carbon and hydrogen; to decompose it requires a certain amount of energy. While the energy of the glowing wire or of the exploding cap causes a local decomposition at the point of contact, it is not sufficient to spread the decomposition further. Acetylene forms an explosive mixture with air; so does illuminating gas. The odor of acetylene is unpleasant; so is the odor of the water gas used generally in the United States, and the acetylene can be cheaply deodorized.

As the generator system, then, is the general one, the most important question to the consumer is what generator to buy, and it is a perplexing question. The carbide manufacture is so organized that it is everywhere under the control of powerful and responsible companies which sell a guaranteed product. The burners now in use are nearly all good. With generators it is different; the market is flooded with them at all prices, ranging in value from worse than useless to very good, as regards safety, economy, and quality of light. As the generator question is by far the most important and the least understood in the whole acetylene industry, it will be well to give a full account of the results of the experiments which have been made within the last two years on this question. The most exhaustive experiments are those of the English expert, Professor Lewes, and his results agree with those of other observers.

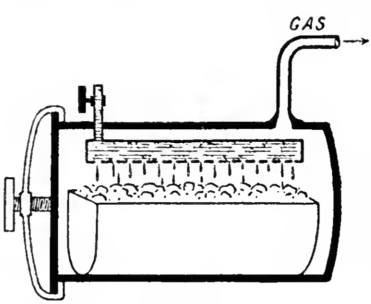
Lewes first determined the amount of heat developed by the decomposition of carbide by water, and the conditions which tend to lessen or increase the intensity of the reaction. The average result of the experiments as to the amount of heat was 446.6 calories for pure carbide, and a little less for commercial carbide (to state this differently, one pound of carbide, when decomposed by water, gives off heat enough to raise the temperature of 446.6 pounds of water 1° C., or to raise the temperature of one pound of water 446.6° C.). As the intensity of the heat developed determines the highest temperature attained during the decomposition, and is a function of the time needed to complete the action, and as the decomposition of carbide in contact with water is extremely rapid, it is evident that the temperature developed may be so high as to cause disaster. All the generators at present before the public may be classified under three heads: 1. Those in which water is allowed to drip or flow slowly on a mass of carbide, the evolution of the gas being regulated by the stopping of the water. 2. Those in which water in considerable volume is allowed to rise in contact with carbide, the evolution of the gas being regulated by the driving back of the water by the increase of pressure in the generating chamber. 3. Those in which the carbide is dropped or plunged into an excess of water.

The conclusions deduced from a large number of experiments were that when, as in type 1, water is allowed to drip or flow in a fine stream upon a mass of carbide, the temperature rapidly rises until after eighteen to twenty-five minutes the maximum is reached, which varies from 400° to 700° C. (720° to 1120° Fahrenheit), and it is probable that in some of the mass the higher limit is always reached, as traces of tar are usually found in the residual lime, in some cases in sufficient quantity to make the lime yellow and pasty, while vapors of benzene and other polymerization products pass off with the gas. Leaving the question of temperature in this type of generator, another important question is the length of time during which the generation of gas continues after the water supply is automatically cut off. It is found that gas is evolved with increasing slowness sometimes for an hour and three quarters after the water supply has ceased, the total volume of gas so evolved being large.

The experiments showed that in any automatic generator of this type the cut-off should be so arranged that one quarter of the total capacity of the gas holder is still available to store the slowly generating gas.

The second class of generators bring about contact either by water rising from below to the carbide suspended in the cage (II, *A*), or by a cage of carbide suspended in a movable bell which, as it falls, dips the carbide into water, withdrawing the carbide from the water as the excessive generation of gas lifts the bell (II, *B*). Lewes found that under certain conditions generators of the type II, *B* were far worse than those of type I.

The trials were made with a movable glass bell, with counterweights, containing a half-pound of carbide. The maximum temperatures reached in four trials were 703°, 734°, 754°, and 807° C. Excessive heating took place in every case; in the last mentioned the temperature was far above the point at which acetylene is decomposed into carbon and hydrogen, a thin black smoke being formed immediately around the carbide while tar vapor poured out. On removing the residue after cooling it was found to be coated with soot and loaded with tar. On several occasions the charge was removed from the generator just after the maximum temperature was reached, and was found to be at a bright red heat.



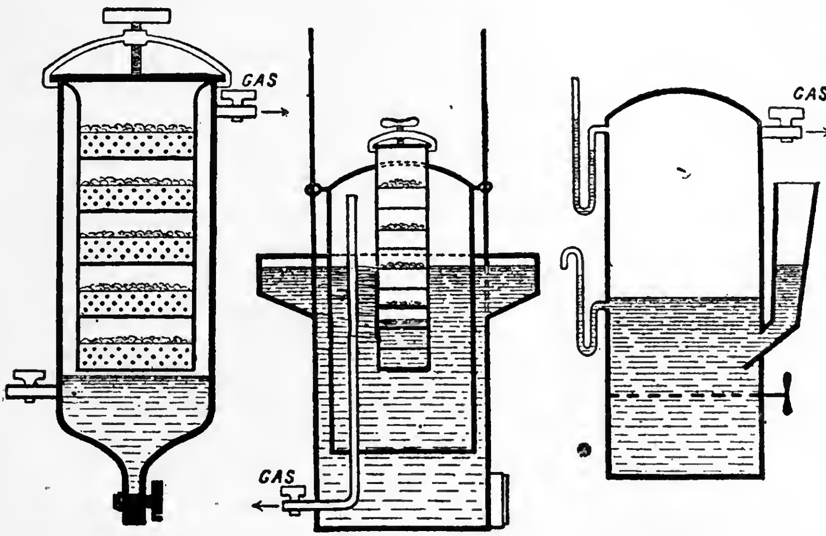
Type I.

Type of Generator.

These experiments are of the greatest practical importance. At 600° acetylene begins to polymerize—i. e., to form more complex hydrocarbons, which are liquid, or solid, at ordinary temperatures. Probably in the generator acetylene is first given off so rapidly that the heat does not act on it, but as decomposition advances into the

Note.—We are indebted to the courtesy of the Progressive Age for cuts showing types of generators.

center of the mass of carbide, the acetylene generated has to pass through the external layers, which, as shown, may be at high temperatures, above that at which acetylene decomposes; thus a considerable amount of gas is lost, and the tar formed may distill into



Type II, *A*. Type II, *B*. Type III.

TYPES OF GENERATORS.

the generator and tubes, clogging the tubes. A more serious evil is the deterioration in the illuminating quality of the gas. Samples of the gas were taken as the maximum temperature was approached, and analyzed with this average result: Acetylene, seventy per cent; other hydrocarbons, eleven per cent; hydrogen, nineteen per cent. This reduces the illuminating value from two hundred and forty to one hundred and twenty-six candles. The hydrocarbons consist largely of benzene, which requires three times as much air for complete combustion as acetylene does. The best possible acetylene burner smokes when the acetylene contains benzene.

At first sight these experiments would seem absolutely to condemn generators of class II, yet the fact remains that some excellent generators are of this type. Under certain conditions excessive overheating may be avoided. The rising bell shown in II, *B* should be discarded. Generators in which the water rises from below, and slowly attacks the carbide, can be made safe if the water is never driven back from the carbide, and the carbide is in separated layers as in II, *A*. Under these conditions the water is always in excess at the point where it attacks the carbide, so that the evaporation, by rendering heat latent, keeps the temperature down, the temperature of the melting point of tin, 228° C., being rarely reached in good generators where these conditions are met.

Undoubtedly the best generators, and the only ones which from a scientific point of view should be employed, are those of class III, in which carbide falls into an excess of water. In such generators it is impossible to get a temperature higher than the boiling point of water, 100° C., while with a properly arranged tank the temperature never exceeds that of the air by more than a few degrees. Under these conditions the absence of polymerization and the washing of the nascent and finely divided bubbles of gas by the limewater in the generator yield acetylene of a degree of purity unapproached by any other form of generator.

When acetylene is burned in air under such conditions that the flame does not smoke, it has been proved by Gréhant that there is no carbon monoxide among the combustion products; the acetylene combines with the oxygen of the air to form carbon dioxide and water ($C_2H_2 + 5O = 2CO_2 + H_2O$). One cubic foot of acetylene requires two and a half cubic feet of oxygen. Supposing a room to have an illumination equal to sixty-four standard candles; this amount of light from candles would use up 38.5 cubic feet of oxygen from the air, and would give off forty-three cubic feet of carbon dioxide; petroleum requires, in cubic feet, twenty-five of oxygen, and gives off forty of carbon dioxide; gas burned with a flat flame requires about twenty-five oxygen and gives nineteen carbon dioxide—with an Argand flame a little less, while with the Welsbach burner gas requires only three oxygen, and gives off 1.8 carbon dioxide; acetylene requires five oxygen and yields four carbon dioxide. So that, light for light, acetylene fouls the air less than any ordinary illuminant excepting the Welsbach gas burner. (With incandescent electric light there is no combustion and no fouling of the air.)

Under the best conditions five cubic feet of acetylene give a light of two hundred and forty candles for one hour, or we may speak of acetylene as a two-hundred-and-forty-candle gas. Yet this statement, though strictly true, may be misleading. When ordinary illuminating gas is tested with the photometer, it is burned from a standard flat-flame burner, burning five cubic feet per hour. Now the amount of light given by such a gas flame is no greater than is pleasant to the eye; it is true that if we burn five cubic feet of acetylene from a suitable flat-flame burner, a light of two hundred and forty candles is given, but it is unfair to take this ratio as representing the actual relative illuminating value of the two lights, because we neither need a light of two hundred and forty candles, nor is such an amount of light issuing from one burner endurable to the eye. One-foot or one-half foot acetylene burners are used for domestic lighting;

light from the best one-foot burners averages thirty-two to thirty-five candles per cubic foot. With acetylene, as with every other illuminating gas, the smaller the burner and consumption, the less light per cubic foot of gas is obtained. Another important point is that while these figures represent the best practical illumination obtained from acetylene by the burners hitherto in use, the standard flat-flame burner does not give the best gaslight; with a good Welsbach burner a cubic foot of illuminating gas will give a seventeen-candle light as an average. The comparison, to be fair, should be between acetylene and the Welsbach light.

The reader will ask whether it is not possible to burn acetylene with other forms of burner, or to use it with Welsbach mantles. Successful acetylene burners of the Argand or of the regenerative type have not yet been introduced; but in Germany a new acetylene burner with Welsbach mantle promises good results. Experiments in England with an acetylene Bunsen burner and Welsbach mantle gave a light of ninety candles per cubic foot of acetylene used. It remains to be seen whether it is necessary to modify the composition of the mantles because of the intense heat of the acetylene Bunsen flame, which gives a temperature of 2100° to 2400° C. (3812° to 4397° Fahrenheit).

It would extend this article to undue length to speak of the various uses of acetylene as an enricher of other gases, but a mixture of acetylene and Pintsch oil gas now in use on all the Prussian state railways deserves mention, as it is a success, and ten thousand tons of carbide will be used this year for lighting cars by this system. Lewes's new invention of a very cheap methane water gas which is enriched by acetylene, carried to the consumer through mains, and burned in ordinary burners, is also promising.

Insurance and police regulations vary for every country. As a rule, restrictions are put on the use of liquid acetylene, and on the amount of carbide to be kept in storage. Generators must stand in separate buildings, which, in towns, must be fireproof.

The Willson patents cover the manufacture of crystalline carbide in the United States, Canada, and the South American states; and, as all carbide made by the electric furnace is crystalline, no carbide can be made independently of these patents in these countries.

In conclusion, it may be predicted that within the next few years acetylene will prove a factor in giving us an improved and cheaper light. Whether this will be an acetylene-Welsbach light or whether the acetylene will be chiefly used as an enricher of cheaper gases the future will show.

THOUGHTS ABOUT UNIVERSITIES.

By WILLIAM KEITH BROOKS,
PROFESSOR OF ZOÖLOGY IN THE JOHNS HOPKINS UNIVERSITY.

YOU are aware that the pedagogue is no longer treated with that deference and respect which he feels to be due to his love of learning. Past is all his fame. Past is the day when the village all declared how much he knew. Nowadays he is accustomed to be told by the rustics, who once gazed and wondered, that he is old-fashioned and out of place in our modern world; that he does not represent the nation; that the love he bears to learning is at fault; and that the university the people want must be universal like an omnibus, with a place for all, either for a single square or to the end.

He is also used to hearing from those successful people of whom all must speak with reverence—those who have demonstrated their superiority by laying their hands on everything they think worth the getting—that he is a mere "bookish theorist," and that they are much more able to show him the path to success than he to tell them anything to their advantage.

Unless he can minister to their comfort or entertainment, or make smooth the royal road to learning, or at the very least help to maintain the patent office, he is told to be content with such treatment as they think good enough for him, and to keep himself to his work of teaching the lower classes to be lowly and reverent to all their betters.

I have been much interested of late by two books on certain aspects of modern society. One treats of the dangers which threaten liberal culture and constitutional government, and all the best products of civilization, through the increasing prevalence of the belief that our institutions have been *devised* by a few for their own selfish ends. So long as men differ in natural endowments the ignorant and the incapable and the unsuccessful must outnumber those whose industry and energy and foresight insure success. As those who have little have always outnumbered those who have much of the desired fruits of civilization, this writer says that one of the great questions of the day is whether, in last resort, the world shall be governed by its ignorance or by its intelligence. He is alarmed by the diffusion of belief that our established institutions do not represent the people, and that they are hostile to the best interest of mankind, and by the prevalence of the opinion that the true way to reform the world and to secure rational progress is to intrust the organization and administration of government and of education and of all matters of public interest and importance to the majority.

The danger so clearly pointed out is real, beyond question; but I can not agree with the author that it is exclusively or distinctively modern. If some in our day interpret the belief that the voice of the people is the voice of God, as conviction that the loudest voice is most divine; if they assert that the man with pure and lofty ideals of education and duty and loyalty is a public enemy; we must remember that so wise a man as Aristotle taught, in the day of Athenian democracy, that the man who is virtuous in undue measure is a moral monster, as justly repugnant to his neighbors as one pre-eminent in vice.

If the first book calls Aristotle to mind, one must often think of Jeremiah while reading the second, for its author is a dismal prophet, who holds that, formidable as unbridled democracy seems, it is helpless in the struggle with organized plutocracy, and that its efforts to shake off the restraints and limitations of social existence can end in nothing but a more crushing despotism, while submission may bring such rewards of merit for good behavior in the past and such prizes for good conduct in the future as seem to the givers to be good investments.

Both writers draw many of their illustrations from the history of our own country, and they hold that our great political contests are struggles between those who wish to maintain our institutions for the sake of what they can themselves make out of them, and those who seek to wreck the ship of state for very similar reasons.

Some hold that, these things being true, they can show the learned professor how he may win back, through the struggle between these two great classes of mankind, some of that confidence in his wisdom which his predecessors enjoyed. They tell him he may make his learning represent the people if he will extend his university until it becomes as universal as the kindergarten, and that he may at the same time increase his popularity with the select if he will devote more of his time and more of his energy to that branch of learning which was in olden times pursued in that secluded cloister called the campus, although it is better known to the polite society of our day through the banjo club, the football team, and the mask and wig club.

If he will cultivate these two fields, and, refraining from the theoretical pursuit of empty generalities, will enter upon a three months' campaign of education at some time when men's minds are stimulated by the heat of faction to welcome calm discussion of the principles of common honesty and good citizenship, he can not fail to win the respect and confidence of all.

When I wrote this last sentence I thought that it was all out of my own head, and I was proud of it; but as I laid down my pen in my satisfaction for a moment's rest, my eye fell upon this passage in the prospectus of a new university—one which is said, in the prospectus, to be not only universal, but cosmopolitan: "When a question arises which divides scholars, like the tariff, the causes and course of the Reformation, money, etc., the student will be referred to the ablest exponents of the opposing sides."

No professor can plead ignorance of the way to enter this new career of usefulness. One can scarcely pick up a college catalogue or a magazine or a newspaper without learning how to make the university universal. One of the simplest plans, with which all are familiar, is to send to men with a reputation for learning a ruled form and a request that each will write, in the proper columns, the price, publisher, and title of the best book on his own subject—mathematics, astronomy, moral science, or whatever it may be—or, if he knows of no such book, that he will write one. An accompanying circular tells how these lists are to be scattered through the innumerable homes of our land, and how diplomas are to be distributed as prizes to those who, after purchasing the books, prepare and submit the most exhaustive permutations of their tables of contents.

Learned men who do not approve this plan are offered a choice from many others: six-week courses in law, medicine, and theology; summer schools for the promotion of science and the liberal arts; questions and answers in the educational column of some journal for the home; or a national university so universal that it shall supply lunches and learning for all out of the public chest, with no doorkeeper to examine passports.

The way to extend the university in this direction is so well understood that I will turn now to another part of our subject, for some may be less familiar with our opportunity to construct a royal road to learning for those who are entitled to use it.

A recent writer on education, who says American universities impose "upon young men in the nineteenth century a curriculum devised by dead-and-gone priests for the young men of the twelfth," calls upon the teachers of America to reconstruct their curriculum on psychological principles. I myself am no psychologist, and while I fail to see how this fact concerns the public, it has recently been pointed out in print, although no one has ever charged me with lack of reverence for the psychologist. In truth, he is to me what the good old family doctor is to many, for I am convinced that it would be hard to name one among all the educational ills that flesh is heir to that he would not be able to throw on the spot, with a good collar-and-elbow hold. I have a prodigious respect for those fine big words *curriculum* and *psychological principles,* and I welcome the plan for reconstructing the curriculum on psychological principles the more eagerly because it is extremely simple and not hard to understand, like some psychological utterances. In fact, it is so very simple and easy that it is sure of enthusiastic indorsement by innumerable children, for this reformer's plan is neither more nor less than the abolition of the pedagogue.

"If," he says, "I was director general of education for all America" (which at the present moment he is not), "I would abolish colleges, but send American youths to travel for two years in Europe. In my opinion," he says, "a father who has sons and daughters of a proper age to go to college will do better by his children if he sends them for two years to travel in Europe than if he sends them for three years to an American or English university."

Admirable and simple as is this plan for ascending Parnassus in vestibuled trains of drawing-room cars, personally conducted by Grant Allen, this psychologist seems to me to err in thinking it new, for it was in high favor in England during the reign of that merry monarch who was always so furious at the sight of books that his queen, who loved reading, had to practice it in secret in her closet.

Euphranor having asked, in the reign of George II, "Who are these learned men that of late years have demolished the whole fabric which lawgivers, philosophers, and divines have been erecting for so many ages? Lysicles, hearing these words, smiled and said he believed Euphranor had figured to himself philosophers in square caps and long gowns; but, thanks to these happy times, the reign of pedantry was over. Our philosophers, said he, are of a different kind from those awkward students. They are the best-bred men of the age, men of the world, men of pleasure, men of fashion, and fine gentlemen. I will undertake a lad of fourteen bred in the modern way shall make a better figure and be more considered in any drawing-room or assembly of polite people than one at four-and-twenty who hath lain by a long time at school and college. He will say better things in a better manner, and be more liked by good judges. I say, when a man observes and considers all this, he will be apt to ascribe it to the force of truth and the merits of our cause, which, had it been supported by the revenues and establishments of the Church and universities, you may guess what a figure it would make by the figure it makes without them. People begin to open their eyes. It is not impossible but the revenues that in ignorant times were applied to a wrong use may hereafter, in a more enlightened age, be applied to a better."

"The money that went to found the Leland Stanford or the

Johns Hopkins University," says the modern reformer, "would have been immeasurably better spent in bringing St. Marks at Venice and the Uffizi at Florence into the lives of innumerable young Americans. Here, then, is the opportunity for a wiser Cornell."

A few years ago an acquaintance of my own, himself an accomplished psychologist, brought with him to Washington a young man, a native of north Greenland, that he might take into his life the best substitute for St. Marks at Venice that this country affords. While limited in range, the results were as definite as one could wish, for two of the most refined delights of our wonderful civilization—rum and horses—were at once taken into the life of Eskimo Joe with all the fresh enthusiasm of youth. In his boyish impetuosity he could not see why a hired horse should not have the fleetness of Santa Claus's reindeer and the endurance of wild dogs; and as few horses survived the first lesson, the psychologist soon reconstructed the curriculum, for Joe's progress in rum and oysters was most gratifying. You who have attended my lectures in anthropology will remember that Nature has bestowed on the Eskimos two endowments which are not elsewhere found united, although they are exhibited separately in high perfection by the anaconda and the camel. Joe was able to load himself with food and drink like a pirate ship victualed for a long cruise, and he became so proficient in three months that a two-year course seemed unnecessary, so he was shipped off to Labrador at the first opportunity, and was left there to carry St. Marks at Venice into the homes of Greenland as best he might. It is clear that our psychological reformer's plan is not new, but he says our curriculum is some thousand years behind the times, and he asks, "Will somebody one day have the wisdom to perceive that the education which sufficed for the mediæval England of the Plantagenets is not absolutely adapted to the America of the nineteenth century?" I myself know so little of the curriculum of that day that this charge may, for all I know, be well founded, and if so it were a grievous fault. For all I know the dead-and-gone priests of the twelfth century may have read Homer in the original Greek, and carried on their studies in trigonometry and navigation with the aid of logarithms and the nautical almanac, although it has come in my way to know something of their method of teaching zoölogy, for my studies have led me to examine a text-book on this subject, which was written early in the twelfth century for the education of the young Queen Adelaide, who was married to Henry I of England in 1121. The dedication is as follows:

"Philippi de Thann into the French language has translated the Bestiary, a book of science, for the honor of a jewel, who is a very handsome woman, Aliz is she named, a queen is she crowned, Queen she is of England, may her soul never have trouble! In Hebrew in truth Aliz means praise of God. I will compose a book, may God be with the commencement!"

As a sample of the zoölogical curriculum of the twelfth century take this chapter:

"Onager by right is named the wild ass; of it the Physiologus says, in his speech, when March in his course has completed twenty-five days, then that day of the month he brays twelve times, and also in the night for this reason, that that season is the equinox, that is that night and day are of equal length; by the twelve times that it makes its braying and its crying, it shows that night and day have twelve hours in their circuit. The ass is grieved when he makes his cry, that the night and day have equal length; he likes better the length of the night than of the day. Now hear without doubt the signification of this. Onager signifies the devil in this life; and by March we understand all the time that we have; by the day we understand good people, by right, who will go in light; and by night we understand those who were Neros; and by hours we understand the number of people. And when the devil perceives that his people decrease, as do the hours which are in the night, after the vernal equinox which we have in March, then he begins to cry, to deplore greatly, as the ass does which brays and crys."

One need not go back to the middle ages for a measure of progress, for all who remember the American college of thirty years ago know there has been notable improvement in this short time, and they also know that every change has not been an improvement. All who are concerned with education see many defects, and wish to do what they can to remedy them, and to increase the efficiency and usefulness of our whole educational system in all its branches from the lowest to the highest, although I believe they still find much wisdom in the advice of the prophet of old, "that we make a stand upon the ancient way, and then look about us and discover what is the straight and right way, and so walk in it."

Many who are now before the public as reformers seem to me to fall into error through belief that our educational system has been *devised* by some one, either in the twelfth century or at some other time, and that they may therefore hope to devise a better. All who know that it is a highly complex and delicate organism which has grown up imperceptibly and naturally in accordance with many needs, fulfilling many different purposes and acting in many diversified and far-reaching ways, know also that while reform always has been and always will be needed, organic change is quite another matter. They know, too, that a disposition to pull it to pieces in the interest of some theory or speculation must inevitably end in disaster, for they must agree with Bacon that "it were good, therefore, that men in their innovations would follow the example of time itself, which indeed innovateth greatly, but quietly, and by degrees scarce to be perceived."

The complaint that learning is no longer treated with due deference is not exclusively modern, for it was enumerated long ago among the things that are not new under the sun; and he who for his own pleasure or distinction devotes himself to work in fields that yield nothing but the interest of the exploration should look to his own pleasure for his reward, since learning is no more exalted by turning it into an aristocratic and exclusive pleasure ground than by making it a shop for profit. While no weak and foolish brother of the laboratory should be permitted to think that he belongs to a favored class or has any claims to support or respect except for service rendered, it is the duty of our graduates to teach the world, by the example of their lives, what the work of the university is.

Lyceum lectures and summer schools and systematic courses of reading are good things, and the common school and the home are the foundation of all education. Travel is a most valuable adjunct, but those who are to profit by it must first know what they go out to see, "for else shall young men go hooded and look abroad little."

No school or college can improve its work by calling itself a university, although the prevalence of belief that its work is the work of a university may bring harm incalculable; for that university is universal, in the best sense of the word, where students are inspired with enthusiasm for truth by the example of those whose minds are "as a mirror or glass capable of the image of the universal world, and joyful to receive the impression thereof as the eye joyeth to receive light."

What nobler task can our graduate undertake than to teach the world that while the benefits which learning confers are its only claim to consideration, these benefits will cease so soon as they are made an end or aim? All men prize the fruit; but who else is there to tell them that the tree will soon be barren if they visit it only at the harvest, that they must dig about it and nourish it and cherish the flowers and green leaves? What better service can he render than to point out that the gifts of learning are like health, which comes to him who does not seek it, but flies farther and farther from him who would lure it back by physic or indulgence?

The two authors I referred to at the beginning can not both be right, and both may be partly wrong, for it is possible that neither plutocracy nor a democratic majority makes a state. No university need humble itself to seek the favor of either plutocracy or democracy if its graduates can convince mankind, by their own lives, that its aim is not to gain deference or success or distinction or reward of any sort, but solely to propagate and diffuse among mankind "that enthusiasm for truth, that fanaticism of veracity, which is a greater possession than much learning, a nobler gift than the power of increasing knowledge."

IN THE LITTLE BROOK.

By DAVID STARR JORDAN.

LONG ago, in the old Devonian times, when life was very leisurely, all the beasts and people that there were lived in the sea together. The air was dull and murky on the land. It was so light that it gave no support to the body, and so those that ventured about in it had to lie prone on the ground all the time wherever they went. So they preferred to stay in the water, where motion is much easier. Then, too, water is so much better to breathe than air, if one has gills fitted for it! He has only to open his mouth and the water rushes in. Then he has only to shut his mouth and the water rushes out backward, bathing his gills on the way. Thus, the air dissolved in the water purifies all the little drops of blood that run up and back through the slender tubes of which the gills are made.

But in those days, besides the gills, some of the beasts of the sea had also a sac in the throat above the stomach in which they could stow away air which they took from the atmosphere itself. This served them in good stead when they were in crowded places, in which the air dissolved in the water would fail them.

And those which were so provided used to venture farther and farther out of the water, pushing their way heavily on the ground. And those which could put forth most effort survived, until at last their descendants were able to maintain themselves on the land altogether. These gave rise to the races of reptiles and birds and mammals, the ancestors of all the land beasts that you know, as well as men and women and all the monkey people. But it was very long ago when this happened, and because these ancestors came finally out of the water they have no part in the story I am trying to tell to-day.

Those that remained in the water grew more and more contented with their condition. Because the medium in which they lived was as heavy as their bodies, they swam without much effort, and effort not being needed, it was not put forth. As there was food enough in the water, they did not need to go on land. As they did not go on land, they did not use their lungs for breathing, the air sac gradually shrank away, or was used for some other purpose, and all the parts of the body became adjusted for life in water, as those of their cousins who left the sea became fitted for the life in air. Being now fishes for good, all the progress since then has made them with each succeeding century more and more decidedly fishy.

And because they are fishes they are contented to live in little brooks, which would not satisfy you and me at all. But our ancestors in the early days were more ambitious, and by struggle and effort won what seems to us a larger heritage.

So it happened one spring when the ice melted out from some little brook that flows down from somebody's hills somewhere toward some river that sets toward the Mississippi, the little fishes began to run.

And first of all came the lampreys, but they hardly count as fishes, for they have yet to learn the first principles of fishiness. A fish is a creature whose arms and legs are developed as fins, having cartilaginous rays spreading out fanlike to form an oar for swimming. But the lamprey has no trace of arm or leg, not even a bone or cartilage hidden under the skin. And its ancestors never had any limbs at all, for the earliest lamprey embryo shows no traces of them. If the ancestors ever had limbs, the descendants would never quite forget it. Some little trace would be kept by the clinging force of heredity, and at some time or another this rudiment would appear. And the lower jaw they lack too, for that is really another pair of limbs joined together in front—as it were, a pair of short hands clasped together and never unlocked.

But though the lampreys have no limbs and no jaws and are not fishes anyhow, they do not know the difference, and come up the brook in the spring, rushing up the rapids, swirling about in the eddies, just as if they were real fishes and owned the brook themselves. They are long, slender, and slippery, shaped like eels, without any scales and with only a little fin, and that along the back and tail, an outgrowth from the vertebral column. The vertebral column itself is limp and soft, the vertebræ only imperfectly formed and made of soft cartilage. In front the lamprey seems to be cut off short, but if we look carefully we see that the body ends in a round disk of a mouth, and that this disk is beset by rows of sharp teeth. A row of the sharpest of these is placed on the tongue, and two of these are above the gullet, for the tongue to scrape against them. And the rest are all blunt and are scattered over the surface of the mouth, which has no lips nor jaws, but is surrounded by a belt of fringes. When the lamprey is hungry he puts his mouth against the side of some fish, exhausts the water between, and then the pressure of the outside water holds him there tightly. When this is done, the fish swims away and the lamprey rides with it, giving no thought to where he is going, but all the while scraping away the flesh with his rasplike teeth. When he has filed off enough fish flesh to satisfy his hunger he lets go, and goes off about his business. The fish, who does not know what hurt him, goes off to get well if he can. Usually he can not, for the water of the brook is full of the germs of little toadstool-like plants, and these fasten themselves on the fish's wounds and make them bigger and bigger, until at last the cavity of the abdomen is pierced and little creatures of many kinds, plant and animal, go in there and plunder all this fish's internal organs, to carry them away for their own purposes.

But when the lampreys come up the April brook it is not to feed on fishes, nor is it to feed at all. Nature is insistent that the race should be kept up, and every animal is compelled to attend to the needs of the species, even though it be at the sacrifice of all else. If she were not so, the earth and the seas would be depopulated, and this is a contingency toward which Nature has never looked.

The lampreys come up the stream to spawn, and while on this errand they fasten their round mouths to stones or clods of earth, that the current may not sweep them away. When so fastened they look like some strange dark plant clinging to the bottom of the brook. When the spawning season is over some of them still remain there, forgotten by Nature, who is now busied with other things, and they wear their lives away still clinging—a strange, weird piece of brook-bottom scenery which touched the fancy of Thoreau.

When the young are hatched they are transparent as jelly, blind and toothless, with a mouth that seems only a slit down the front end of the body. These little creatures slip down the brook unobserved, and hide themselves in the grass and lily pads till their teeth are grown and they go about rasping the bodies of their betters, grieving the fishes who do not know how to protect themselves.

The lamprey is not a fish at all, only a wicked imitation of one which can deceive nobody. But there are fishes which are unquestionably fish—fish from gills to tail, from head to fin, and of these the little sunfish may stand first. He comes up the brook in the spring, fresh as "coin just from the mint," finny arms and legs wide spread, his gills moving, his mouth opening and shutting rhythmically, his tail wide spread, and ready for any sudden motion for which his erratic little brain may give the order. The scales of the sunfish shine with all sorts of scarlet, blue, green, purple, and golden colors. There is a black spot on his head which looks like an ear, and sometimes grows out in a long black flap, which makes the imitation still closer. There are many species of the sunfish, and there may be a half dozen of them in the same brook, but that makes no difference; for our purposes they are all as one. They lie poised in the water, with all fins spread, strutting like turkey-cocks, snapping at worms and little crustaceans and insects whose only business in the brook is that the fishes may eat them. When the time comes, the sunfish makes its nest in the fine gravel, building it with some care—for a fish. When the female has laid her eggs the male stands guard till the eggs are hatched. His sharp teeth and snappish ways, and the bigness of his appearance when the fins are all displayed, keep the little fishes away. Sometimes, in his zeal, he snaps at a hook baited with a worm. He then makes a fierce fight, and the boy who holds the rod is sure that he has a real fish this time. But when the sunfish is out of the water, strung on a willow rod, and dried in the sun, the boy sees that a very little fish can make a good deal of a fuss.

When the sunfish goes, then the catfish will follow—"a reckless, bullying set of rangers, with ever a lance at rest." The catfish belongs to an ancient type not yet fully made into a fish, and hence those whose paired fins are all properly fastened to the head, as his are not, hold him in well-merited scorn. He has no scales and no bright colors. His fins are small, and his head and mouth are large. Around his mouth are eight long "smellers," fleshy feelers, that he pushes out as he crawls along the bottom in search of anything that he may eat. As he may eat anything, he always finds it. His appetite is as impartial as that of a goat. Anything from a dead lamprey or a bunch of sunfish eggs to a piece of tomato can is grateful to him. In each of the fins which represent his arms is a long, sharp bone with a slimy surface and a serrated edge. These are fastened by a ball-and-socket joint, and whenever the fish is alarmed the bone is whirled over and set in place; then it sticks out stiffly on each side. There is another such bone in the fin on the back, and when all of these are set there is no fish that can swallow him. When he takes the hook, which he surely will do if there is any hook to be taken, he will swallow it greedily. As he is drawn out of the water he sets his three spines, and laughs to himself as the boy pricks his fingers trying to get the hook from his stomach. This the boy is sure to do, and because the boy of the Mississippi Valley is always fishing for catfish is the reason why his fingers are always sore. The catfish is careless of the present, and sure of the future. After he is strung on a birch branch and dried in the sun and sprinkled with dust and has had his stomach dug out to recover the hook, if he falls into the brook he will swim away. He holds no malice, and is ready to bite again at the first thing in sight.

The catfish uses his lungs as an organ of hearing. The needless lung becomes a closed sac filled with air, and commonly known as the swim bladder. In the catfish (as in the suckers, chubs, and most brook fishes) the air bladder is large, and is connected by a slender tube, the remains of the trachea, to the œsophagus. At its front it fits closely to the vertebral column. The anterior vertebræ are much enlarged, twisted together, and through them passes a chain of bones which connect with the hidden cavity of the air. The air bladder therefore assists the ear of the catfish as the tympanum and its bones assist the ear of the higher animals. An ear of this sort can carry little range of variety in sound. It probably gives only the impression of jars or disturbances in the water.

The catfish lays her eggs on the bottom of the brook, without much care as to their location. She is not, however, indifferent to their fate, for when the little fishes are hatched she swims with them into shallow waters, brooding over them and watching them much as a hen does with her chickens. In shallow ponds the young catfishes make a black cloud along the shores, and the other fishes let them alone, for their spines are sharp as needles.

Up the brooks in the spring come the suckers, large and small—coarse, harmless, stupid fishes, who have only two instincts, the one to press to the head of the stream to lay their eggs, the other to nose over the bottom of the stream wherever they go, sucking into their puckered, toothless mouths every organic thing, from water moss to carrion, which they may happen to find. They have no other habits to speak of, and when they have laid their eggs in a sandy ripple they care no more for them, but let go of life's activity and drop down the current to the river whence they came. There are black suckers and white suckers, yellow ones, brown ones, and mottled, and there is more than one kind in every little brook, but one and all they are harmless dolts, the prey of all larger fishes, and so full of bones that even the small boy spits them out after he has cooked them.

Then come the minnows, of all forms and sizes, the female dull colored and practical, laying her eggs automatically when she finds quiet water, and thinking no more of them afterward. The male, feeble of muscle, but resplendent in color, with head and fins painted scarlet or purple, or silver white, or inky black, as may be most pleasing to his spouse. His mouth is small and without teeth, for he feeds on creatures smaller than fishes, and his head in the spring is covered with coarse warts, nuptial ornaments, which fall off as soon as the eggs are properly disposed of. In the little brook which comes to my mind as I write two kinds of minnows come up the stream together before the others realize that it is verily spring. The one is small, dainty, translucent, and active, swimming free in the water near the surface and able to take care of itself when pursued by a sunfish or bass. Along the side of its body are two black stripes not quite parallel, and between and below them the silvery scales are flushed with fiery scarlet. The fins are all yellow, with scarlet at base, and as the male passes and repasses before the female all these colors, which she has not, grow brighter than ever.

The next is a larger fish, clumsy in form, hugging the bottom as he swims. The whole body of the male is covered with coarse white warts, and across each fin is a bar of black, white, and orange. This minnow feeds on mud, or rather on the little plants which grow in mud, and his intestines are lengthened out proportionally. In fact, they are so long that, to find room for them, they are wound spool-fashion about the air bladder in a way which happens to no other animal.

Of the other minnows, the one attracts his female by a big, jet-black head; another by the painted fins, which shine like white satin; another by his deep-blue sheen, which is washed all over with crimson. In fact, every conceivable arrangement of bright colors can be found, if we go the country over, as the adornment of some minnow when he mates in the spring. The only exception is green, for to the fishes, as to the birds, green is not a color. It only serves to cover one, while the purpose of real color is to be seen.

And there are fishes whose colors are so placed that they are hidden from above or below, but seen of their own kind which looks on them from the side.

The brightest fishes in the world, the "Johnny darters," are in our little brook. But if you look at them from above you will hardly see them, for they are dull olive on the back, with dark spots and dashes like the weeds under which they lie. The male is only a little fellow, not so long as your finger and slim for his size. He lies flat on the bottom, half hidden by a stone, around which his tail is twisted. He will stay there for hours, unseen by other fishes, except by his own kinsmen. But if you reach down to touch him with your finger he is no longer there. The tail straightens out, there is a flash of blue and scarlet, and a foot or two away he is resting quietly as before. On the bottom is his place, and he seems always at peace, but when he moves his actions are instantaneous and as swift as possible to a creature who lives in the water. On the bottom, among the stones, the female casts her spawn. Neither she nor the male pays any further attention to it, but in the breeding season the male is painted in colors as beautiful as those of the wood warblers. When you go to the brook in the spring you will find him there, and if you catch him and turn him over on his side you will see the colors that he shows to his mate, and which her choice through ages has tended to develop in him. But do not hurt him. He can only breathe for a moment out of water. Put him back in the brook and let him paint its bottom the colors of a rainbow, a sunset, or a garden of roses. All that can be done with blue, crimson, and green pigments in fish ornamentation you will find in some brook in which the darters live. It is in the limestone brooks that flow into the Tennessee and Cumberland where they are found at their brightest, but the Ozark region comes in for a close second.

There will be sticklebacks in your brook, but the other fishes do not like them, for they are tough and dry of flesh, and their sharp spines make them hard to swallow and harder still to digest. They hide beneath the overhanging tufts of grass, and dart out swiftly at whatever passes by. They tear the fins of the minnows, rob the nests of the sunfish, drag out the eggs of the suckers, and are busy from morn to night at whatever mischief is possible in the brook.

The male dresses in jet-black when the breeding season is on, sometimes with a further ornament of copper-red or of scarlet. The sticklebacks build nests in which to hide their eggs, and over these the male stands guard, defending them with courage which would be dauntless in any animal more than two inches long. Very often he has to repel the attacks of the female herself, who, being relieved of all responsibility for her offspring, is prone to turn cannibal. Even the little dwellers of the brook have their own troubles and adversities and perversities.

Last of all comes the blob, or miller's thumb, who hides in darkness and picks up all that there is left. He is scaleless and slippery, large of head, plump of body, and with no end of appetite. He lurks under stones when the water is cold. He is gray and greenish, like the bottom in color. He robs the buried nests of eggs, swallows the young fishes, devours the dead ones, and checks the undue increase of all, not forgetting his own kind. When he has done his work and the fall has come and gone, and the winter and the spring return, the brook once more fills with fishes, and there are the same kinds, with the same actions, the same ways, and the same numbers, and one might think from year to year, as the sun is said to do, that these were the selfsame waters and the selfsame fishes mating over and over again and feeding on the selfsame food.

But this is not so. The old stage remains, or seems to remain, but every year come new actors, and the lines which they repeat were "written for them centuries before they were born." But each generation which passes changes their lives just a little, just as the brook and the meadow itself is changing.

WHITE WHALES IN CONFINEMENT.

By FRED MATHER.

THE dolphin family (*Delphinidæ*) contains nine genera, with only one species in each, but the most interesting one is the white whale (*Delphinapterus leucas* of Pallas, or *D. catodon* [Linn.] of Gill), because it is the only one that can be kept in confinement and its habits observed under semi-domestication. It has fallen to my lot to care for several of these animals in confinement, and to have a chance to note their peculiarities.

"The Great New York Aquarium," at Broadway and Thirty-fourth Street, New York city, was built by Messrs. Coup and Reiche, and opened in 1876. Mr. Butler was the superintendent. I supervised fish culture, and when not otherwise engaged made collections of fishes and invertebrates in Bermuda and in other parts. In 1877 I had charge of their branch aquarium at Coney Island. At both places we had many white whales at different times, for the management would keep whales penned up on the St. Lawrence River to replace those which died, and would never show more than two at a time, claiming that they were rare animals and only to be had at "enormous" expense. The aquarium was a private concern; admission fifty cents; and as the owners were W. C. Coup, a former circus proprietor and once the business manager of Barnum's Circus, and Henry Reiche, an animal dealer, who would sell you giraffes, elephants, or white mice, the attractions were duly exaggerated by the press agent, no matter what the facts might be. This is why we kept a reserve stock of white whales. It would never do to have the public know that they were common during the summer in the St. Lawrence, and when one was getting weak another would be sent down, and the public supposed that the same pair was on exhibition all the time.

This species is common in the North Atlantic, North Pacific, and Arctic Oceans. According to the late Prof. G. Brown Goode, "stragglers have been seen in the Frith of Forth, latitude 56°, while on the American coast several have been taken within the past decade [1880] on the north shore of Cape Cod. They are slightly abundant in New England waters, but in the St. Lawrence River and on the coast of Labrador are plentiful, and the object of a profitable fishery. They abound in the Bering and Okhotsk Seas, and ascend the Yukon River, Alaska, to a distance of seven hundred miles. The names in use are beluga and whitefish among whalers, porpoise, dauphin blanc, marsouin or marsoon in Canada, and keela luak with the Greenland Eskimos" (Fisheries Industries).

The white whale grows to be sixteen feet long; we never had one over ten feet in length, but they were billed, showman fashion, to be much longer. An adult will yield from eighty to one hundred gallons of good whale oil, besides several gallons of more valuable oil from the head which is used on clocks and watches under the trade name of "porpoise-jaw oil," which is sent in a crude state to manufacturers on Cape Cod, who refine it and free it from all tendency to gum. The skins make a leather that is waterproof and stands more hard service than any other known leather. Large quantities of it are sent to England and made into "porpoise-hide boots" for sportsmen, and in Canada the hides are converted into mail bags. The flesh is eaten to some extent by the fishermen, fresh, salted, and smoked.

Zach. Coup said: "I have eaten the fresh steaks several times, and found the meat a fair substitute for beef when the choice was between fish and bacon as a continuous diet, down on the islands where these three things were the only possible variation in the line of animal food, and a very limited choice in the vegetable line, comprising dried beans and rice, for when I was with them there was a scarcity of potatoes for seed, and canned goods had not attained their present popularity, even if these poor fishermen had been able to buy them."

The fat, oily blubber is an overcoat, a nonconductor of heat, and is between the muscle and the skin, as is largely the case with the hog, and, like the latter animal, there is savory muscle which may be cut into succulent steaks below it.

At first the white whales were not in my care, but, being strange animals, were watched with curiosity. The whale tank was as nearly circular as a twenty-sided tank could be whose glass plates were four feet wide with iron standards between, making a pool of about thirty feet in diameter. The pool was of cement and tapered down to an outlet about three feet below the floor, for drainage, and on the floor the cement basin arose two and a half feet, while the panes of one-inch glass were six feet high, with the water line two feet below the top of the glass. This gave the spectators a view of the animals below water, and of their backs as they came up to blow. The white whale and the harbor porpoise (*Phocæna brachycion*), known as the herring-hog, etc., do not make as much of a "spout" as the larger whales do; they roll up and exhale either less strongly or with less water over the blow-hole than their larger relatives. They merely send a mist into the air which can not be seen at a distance of a thousand yards, while the "blowing" of the larger whales may be seen for miles. Half a century ago we boys were taught by the text-books that the whale—there was only one mentioned—drew in water through its mouth, strained out the jellyfishes and other life, and then ejected the water, after the manner of a fire engine, through the top of its head. That this nostril, equipped with the best water-tight valve ever invented, enabled an air-breathing mammal to exhale and inhale, without getting much water into its lungs, we never suspected. If we thought about it at all we looked at the whale as a fish, having gills somewhere, and let it go at that. As our laws speak of "whale fisheries" and "seal fisheries" in connection with these great aquatic mammals, it would be just as correct to speak of all animals which frequent the water as "fishes," and legislate on the "muskrat fisheries," "mink fisheries," etc.; there is really no difference.

I have seen newspaper reports that about thirty years ago a white whale, brought there by a Mr. Cutting, lived in captivity in Boston for two years. Beyond the fact that one was brought there by a Mr. Cutting, and was on exhibition about that time, is all that I have been able to learn, and it is doubtful if it lived one year (see Fisheries Industries, section 1, page 19). One was exhibited at Barnum's old museum, at Broadway and Ann Street, New York, that is said to have lived nine months and was then burned up when that building burned, in March, 1868. As these animals only come into the St. Lawrence, where all live ones have been captured, in May and June, there is no reason to doubt that it did live in confinement for nine months, but none that have been exhibited since that time have survived more than half as long, and I have had personal knowledge of every one since Barnum's.

Coup's Broadway Aquarium opened on October 11, 1876—too late to get a white whale that year. But early next spring Mr. Coup sent his brother to the St. Lawrence River for specimens. This brother, "Zach.," had never seen a whale, but he had full instructions concerning their care from Professor Butler, who had charge of the one at Barnum's Museum. There was an air of mystery about he expedition, and in May "Zach." brought a solitary specimen and at once went for more. The town was billed, the daily press was worked in true circus fashion, the crowd came and expressed various opinions. Standing by the tank, I heard strange comments:

"Do you call that little thing a whale?" This to an attendant.

"Yes, sir, it's a white whale from the northern coast of Labrador, the only one ever captured or ever seen by the oldest whaleman. It was reported to have been seen near the entrance to Hudson Bay, and Mr. Coup fitted out an expedition and captured it at an expense of over one hundred thousand dollars." He had evidently been reading what the press agent had stuffed into the newspapers.

The visitor took another look and remarked: "The papers said it was twenty feet long; I should think it might be six feet, but no more."

"Well," answered the attendant, "water is mitey deceivin', an' that whale is more'n three times as long as it looks. The fact is, the papers did report it to be longer than it is, for when we drew off the water to clean the tank yesterday we put a steel tape over the whale and it measured just nineteen feet eleven inches and a half."

Then a rural couple came, and she remarked: "Oh, I'm so glad we came here, and can tell the folks that we've seen a real live whale!"

"Lucy," said he, "this city is full of all kinds of cheats, an' I don't believe that thing is alive more'n Methuselah is; it's some indy-rubber contraption with clockwork in it that makes it go round and puff in that way."

After the season for hatching trout and salmon was over, in April, I was detailed to build a branch aquarium at Coney Island, with instructions to construct a whale tank the first thing, in order to be ready for the next arrivals. I employed a maker of beer vats, and he brought three-inch planks for the bottom, staves eight feet high, and iron for hoops. The tank was to be twenty-five feet in diameter, with a "chime" nine inches below the bottom, making the tank seven feet deep inside. It was to set with its top eighteen inches above the soil, which was to be the water line, giving the whales five feet and a half of water—little enough when we realize that a ten-foot animal has a diameter of nearly three feet. Heavy timbers were laid under the bottom of the tank, carefully leveled, for no weight can be borne by the staves in a tank of that size.

All this was planned, as well as the engine and pumps, and was well under way, when I received an order from Mr. Coup to go to Quebec and bring down two whales while Zach. went for more. Then I learned the secrets of the live white whale trade. The first whale had been kept back until it could be delivered at night, and its transportation was a mystery intended to arouse the curiosity of the public.

At the railroad station at Quebec two boxes were turned over to me. They were about fifteen feet long, four feet wide, and four feet deep. They were upholstered with "bladder wrack," a most soft cushion, and in each box a white whale lay on these pneumatic cushions. A plug in the bottom of each box had let the water out while the boxes were being lifted by the rope handles on the sides, but when on the cars the plugs were replaced and water to the depth of a foot was poured in; this served to keep the under parts moist, while frequent sponging or the use of a dipper served to keep the skin from drying. The nostril, or "blow-hole," needed the most attention, for it has a valve which must not be allowed to get even partially dry, and a saturated sponge was kept suspended over this all the time during the journey by rail to New York.

The white whale is a very timid animal, and comes up the St. Lawrence in May and June, when the young are brought forth; it is believed that they then go to the river to avoid their enemies, among which is the "killer" or orca whale. Their food, according to Professor Goode, is "bottom fish, like flounders and halibut, cod, haddock, salmon, squids, and prawns." From my knowledge of this whale in confinement I am surprised at the above list, for those under my observation not only preferred live eels, but could not swallow one whose diameter was over one inch, and it was difficult to get quantities of eels as small as three quarters of an inch in diameter, especially when an adult whale would consume about twenty pounds in a day. When larger eels were placed in the tank they would be taken out dead in a day or two with their sides scratched and torn by the small teeth of the whale which had failed to swallow it. We tried other food, for eels are quite expensive in New York city, costing fifteen and eighteen cents per pound, but the whales refused small flatfish, flounders, etc., and the only other food they ate was small tomcods. They refused dead herrings and all fish that were cut in pieces.

The animals are captured at the small French fishing village of Rivière l'Ouelle, on Isle aux Coudres, seventy miles below Quebec, where life is as primitive as it was two hundred years ago in this, one of the oldest of Canadian settlements. Luke Tilden, one of our aquarium men, who went up with Zach. Coup, told of the capture of the whales, and the following is from notes taken by me as Luke told it: The men all fish and the women do a little gardening, but their harvest is the marsouin, a name common to the white whale and to the black porpoise. A fair white whale will weight eight hundred pounds and yield nearly one hundred gallons of oil worth fifty cents per gallon, so that when they trap twenty in a season it means prosperity to the colony; in 1874 they took one hundred, but the catch has fallen off since. "When we reached the island," said Luke, "we went straight to Father Alixe Pelletier and donated ten dollars to the Church for prayers for our success, and it was well invested.

The good old man is the head of that colony and keeps everything straight. In 1863 there was an epidemic of indifference to the Church, and the men went to the bad, got drunk, fought, fished on Sundays, and reviled the priest, withholding all dues to him. Then he said, 'God is angry with you, and to punish you will send no more marsouin until you repent.' They laughed at him, and for three years no marsouin came to them, and they were very poor. They went to the father on a Christmas day and implored him to intercede for them, and he did. The next spring there was a great catch of marsouin, and the men have remained faithful since.

"The tides here rise and fall some twenty feet, and the whales are trapped in an inclosure made of poles, the entrance to which is closed when a school enters. The pound is about a mile square, and is made of slim poles put two feet apart, space enough to let a whale through, but they will not attempt it. The tide falls and leaves them on the mud, quaking with fear. When we want live ones the boxes are made, padded with seaweed, shoved out over the mud, tipped on one side, and the whale rolled into it, where its struggles soon put it on an even keel, and then it gives up and does nothing but breathe as the boxes are taken on board a schooner for Quebec."

I was fortunate in getting the above story from Luke Tilden, for a few weeks afterward he died in the aquarium; and Zach. Coup would tell nothing that could be relied on, not even to the locality where the whales were caught.

The white whale is the only one of its tribe that can be captured in the manner related, because of its cowardly timidity. The harbor porpoise, or "herring-hog," would jump nets and break barricades or die. It would not bear the confinement of an aquarium, for it would leap out of the tanks or dash its brains out in trying to do so; but, once placed in a tank of either salt or fresh water, the white whale starts to circle it, always to the left, with the sun, and contentedly blows at intervals of from five to fifteen minutes, and seems as contented as a canary bird in its cage.

The whale does not always swim in circles to the left when free, and why it does so in confinement is a question. I merely assert the fact. Perhaps wiser men know why perfectly still water in a wash-bowl will rotate to the left with an accelerated motion when the plug is withdrawn, but I do not. As the motion to the left is invariable there must be a rule for it, but, granting that this motion has some relation to the motion of the earth, the question of how this affects the voluntary movements of an animal remains to be answered. I have watched over a dozen white whales in captivity, dumped into tanks from the most convenient side without regard to the direction of their heads, and every one turned and circled to the left. The question arises, Why do they do this? At the new aquarium now at Battery Park, New York city, the big sturgeon always circles to the left except when feeding.

The two whales at Coney Island were good-sized ones, nearly ten feet long, and they raced around, side by side, and played for nearly two hours before they began to take the eels which had been in the tank several days, although the large mammals had been without food for at least seven days. On the way down I had noticed a difference in the sound of their breathing, that of the female being sharp and clear, while her mate seemed to have a hoarseness, and occasionally gave something like a cough. I called attention to this and told Mr. Coup that the animal had some lung trouble. He consulted a man who professed to know about these animals, and then reported his opinion that the cough was nothing to fear, "merely a little water in the blow-hole."

"This may be true," I replied; "I'm not a medical man, but I've heard many consumptives cough, and that whale imitates them. I doubt if it lives a month."

It lived just twenty-six days after its arrival at Coney Island. The last five days of its life it took no food, and its labored breathing was annoying to all who knew the cause of it. Then came a touching display of affection. The female slackened her pace day by day to accommodate it to that of her constantly weakening companion, and as the end neared she put her broad transverse tail under his and propelled him along. He stopped breathing at 10 A. M., but his mate kept up her efforts, occasionally making a swift run around the tank, as if to say, "Come, follow me," and then slowing up at his side, resumed the work of sculling him along, as before. Rude men expressed pity for the living one, and after my men had rigged a derrick and hoisted her mate from the pool she would rise higher out of water when she came up to blow, remembering that he had gone out over the top of the tank. An autopsy by local physicians, whose names have been forgotten, assisted by a medical student then in my employ, now Dr. J. R. Latham, 126 West Eleventh Street, New York city, disclosed the fact that the whale died of pneumonia.

A white whale which reached the Broadway aquarium about July 1st, after mine came, lived seven months, dying January 28, 1878. My whale was either diseased when captured or took a cold at Isle aux Coudres. The New York one was sound all summer, and I told Mr. Coup that it might live for years, but the artificial heat of the aquarium in winter was not what a subarctic animal could endure, and it succumbed as most of Peary's Eskimos did in New York last winter. The autopsy on this whale was performed by Dr. F. D. Weisse, professor of practical and surgical anatomy of the medical department of the University of the City of New York, assisted by Prof. J. W. I. Arnold, of the same university, and Dr. Liautard, superintendent of the Veterinary College. They agreed that pneumonia was the cause of death, induced by a change of temperature of the water in which the animal had been kept. The official measurements of this female specimen, whose organs were kept in the two institutions named, were: nine feet six inches from snout to tail tips; three feet between tips of caudal fins, with a body breadth of twenty inches and a head breadth of thirteen inches. The lungs, weighing twenty-two pounds, presented on dissection the appearance of having been affected with chronic catarrhal pneumonia. The liver weighed nineteen pounds. The four stomachs were all free from any trace of previous disease.

In looking up the life history of the white whale when opportunity offered, during the last twenty years I have consulted many old whalemen, and they all say that whales of all kinds take their babies on their flukes and scull them along as my female sculled her dying and dead partner. This must be a fact, for the little one could never swim with its parent. But another question arises: Is this purely a female instinct to provide for its young, which was, in the case of my pair, developed into a desire to preserve a companion? or, in other words, would a male have done this, or would a female have done it if she were free and had other companions? Was it love for her mate, or a feeling of selfishness at her lonely position? My female was afterward sent to England in the old transportation box, and was nine days without food, for they will not swallow food in transit, and it lived four days in London, clearing more than enough to pay for the animal and all expenses.

When the free aquarium at Battery Park, New York city, was opened, December 10, 1896, there was talk of getting white whales the next spring, but there was no way to employ men to go for them at a stated salary, as they would have to pass a civil-service examination and become regularly appointed employees of the city. In this emergency Mr. Eugene G. Blackford came forward and advanced the money for the expedition, and it started early in May. On June 4th Professor Butler delivered a pair of them to the superintendent, Dr. Bean. I was aware of their coming, and was at the aquarium, and so was Dr. Latham. The male was lead-colored, was said to be a year and a half old, and was nine feet long. The female was of the usual cream-color, ten feet and a half long, and was said to be a year older than her mate. It is known that young and immature specimens are darker than adults, but I am skeptical about the ages, especially as there is a half year credited to each at the exact time the young are brought forth, and do not know on what the ages are based further than that the young are darker in color for a time.

"How does the breathing of the big one sound to you?" the doctor asked.

"Like ours at Coney Island that died from lung trouble," I replied, "and I would not have brought that animal down unless it was the only one to be had during the season."

"I think I'll give her about ten days to live," replied the doctor.

As these were not my whales, I declined to talk of their prospects of life to several reporters who knew me, and the whale in question died of pneumonia on June 11th, just a week after its arrival in New York, and several days before the trained ear of Dr. Latham had allotted its span of life.

The male came to its death by an accident at 9 P. M. on June 24th, just twenty days after arrival. An eel got into its blow-hole and it drowned. According to an account published in the New York Sun of Monday, July 26, 1897, said to be obtained from Dr. Tarleton H. Bean, director of the aquarium, the whale "was as healthy a one as ever spouted until late on Friday afternoon, the 24th, when one of the keepers noticed that something was wrong. His attention was attracted by the loud wheezing that accompanied each blow that the whale made when he came up for air. The wheezing could be heard all over the aquarium. Dr. Bean was sent for. He was certain that the whale's lungs were all right. He cited a fact, known to the custodian and to all the keepers, that the mammal for the past month had remained under water a little longer after he came to the surface to blow. This convinced Dr. Bean that the whale's lungs were sound and that some other cause of illness must be found."

Then the whale coughed out a piece of an eel that it had bit in two, and as it came up to blow again there was another piece hanging from the blow-hole which could not shut, and so let water into the lungs. Dr. Bean ordered the water drawn off the tank in order to get at the animal, but a former superintendent, who had planned the tanks, had put in such small drainage pipes that by the time the water was drawn down so that the men could get at the whale it was dead.

I do not believe that a white whale lived two years in Boston, because this subarctic animal could not endure the extremes of Boston's temperatures without contracting lung disease in some form. Think of such an animal living through climatic conditions that an Eskimo can not stand, and in a public institution where thousands of people are vitiating the air!

Animals which live wholly in water are more susceptible to changes of temperature than those which live on land. The white whale can be kept the year round in New York city if it can have a refrigerating plant to give it the temperature which it needs, and proper food.

We bring polar bears to New York which suffer in summer, if not in our comparatively mild winters, and tropical animals which barely survive, but these land mammals are not so susceptible to climatic influences as are the fishes and the purely aquatic mammals, like the whales. These can never be kept long by the crude means which have been employed. From the purest air they have been changed to the more or less vitiated air where thousands of human beings are crowded and in a temperature which is unnatural. If we would keep them we must give them better chances for living than in open tanks in the summer temperature of New York.

UNUSUAL FORMS IN PLANTS.

By BYRON D. HALSTED.

THE unexpected is apt to occur. Along with the regularity in living things, which we call "uniformity of Nature," there is so strong a tendency to vary that one almost expects to find a turn in the avenues of life sooner or later, and that gradual or sudden, as the case may be. We will not stop to discuss the open question of whether we are possessed by an inherent quality of variation, or as creatures of circumstances, subject to the controlling forces of our environment.

Yesterday while looking at a row of seedling peaches, all from the same lot of pits, one of the miniature trees was found to be bronze or copper colored throughout. This set me to thinking. Here was a "sport," as it is termed, and if I take good care of the abnormity, bud it into common stock, etc., the landscape architects and ornamental gardeners may thank me for the novelty that will please their wealthy patrons.

Leaving aside the abnormal as met with in the animal world, for much of it is more painful than otherwise to contemplate, let us glance at some of the unusual things occurring among plants.

One first thinks of some strange forms in leaf, and if the eyes are opened to them they may be met with upon every hand. The "four-leaf" clover is lucky perhaps only because the finder is sharper-eyed than others, and stands a brighter chance of seeing success as it crouches almost invisible in the wild grass, the tilled field, or wherever the eyes may be set to find it.

The child who brings me the oddities of vegetable forms is knowing in the normals of his class of curiosities, or else he would not see the novelties from the finding and exhibiting of which he gains so much pleasure. The person who is familiar with the striking beauty of the cardinal flower (*Lobelia cardinalis*) is the one who rejoices at the variations that may occur in the tints of the bright corolla. His delight would reach a high pitch should the conspicuous spikes be found upon dry ground, and not by the bank of some stream half hidden by the overhanging grass. But should the wandering plant display white flowers, then an albino of a most interesting kind has been met with, and some reason for it is sought in the unusual locality. Only a few days ago a white variation of the *Lobelia syphilitica*, cousin to the cardinal, was seen by the writer treasured in the Botanical Garden at Cambridge, Mass., and it called to mind the rage for pink water lilies, that twenty years ago were only met with wild in ponds at Plymouth, Mass. I asked an expert recently if there was any call for the pink or "Plymouth" lilies, and he informed me that the fad had died out with the transplanting and widespread culture of the pink "sports" of the nymphæa ponds.

Abnormal colors in flowers are among the most common freaks in wild plants, and none are more frequent than the albinos. One could fill a page with instances of this sort. Some of our most common weeds, as the moth mullein (*Verbascum blattaria*), have a large percentage of the plants with white blossoms, and the patches of the white interspersed with the normal yellow-flowered plants in poorly kept meadows and neglected land has led the writer to gather seed of each to test the truth of the opinion that the white strain may be transmitted to the offspring, but the proof is not yet at hand.

The writer knows where there is a patch of the hound's tongue (*Echinospermum*) with a good sprinkling of plants producing white corollas instead of the normal deep maroon. The two colors make a good subject for students who are gaining an elementary knowledge of the stability of species, and the range of striking variations that must be allowed for them.

Next to the albinos the instances where the floral parts approach leaves in size and color are the most common. A few weeks ago while passing through a field once devoted to corn, but now overgrown with weeds, and therefore of special interest to a botanist, my eyes fell upon a daisy plant all the heads of which were with olive-green ray flowers instead of the ordinary pure white ones. These rays were smaller than the normal and quite inclined to roll, as shown in Fig. 1, and form quills, as seen in some of the fancy chrysanthemums. By the way, our common field daisy is a genuine chrysanthemum, and that which is produced in one species under the guiding, fostering hand of the skilled gardener was here shadowed forth in the field of waste land.

A week or so later, while going through a similar field in an adjoining county to the one where the daisy freak was found, I came upon nearly the same thing as seen in the heads of the "black-eyed Susan," or cone flower (*Rudbeckia hirta* L.). Here were the two leading weedy daisies, the white and the yellow, the former coming

Fig. 1.—Green and Normal Oxeye Daisy Heads.

to our fields from the East and across the sea, while the latter, as a native of our Western prairies, journeys to make a home here and help to compensate by its pestiferous presence for the vile weeds that have gone West with the advance of civilization. Both of these daisies revealed that tendency in them to vary in their floral structures that if made use of by the floriculturist might result in forms and colors as attractive and profitable as met with in their cousins the chrysanthemums of the Orient.

Perhaps the season which we have had, with its excess of moisture and superheat, has made the abnormal forms more abundant than usual. The even current of life has been met by counter streams, so to say, and the channels were broken down. In walking through a meadow in early June it was a common thing to find the spikes of the narrow-leaved plantain (*Plantago lanceolata* L.) branched and compounded into curious shapes. Some of the normal and malformed spikes are shown in Fig. 2.

FIG. 2.—MALFORMED HEADS OF PLANTAGO LANCEOLATA.

As a tailpiece to this portion of the subject it is a pleasure to introduce a freak among the native orchards, as shown in Fig. 3. A word of explanation is needed of the normal form of the lady's slipper here shown. As found in the moist woods, the plant above ground consists of two leaves and a single pink and strange-looking blossom terminating the stalk. This is the rule, and it has been strictly adhered to, so far as the writer knows, for centuries with a single exception, and that exception is the one here presented. It is as remarkable as a double-headed dog, and as difficult of explanation as the twin thumb.

Perhaps the best way is to make no attempt to account for the freak, and leave the subject open for those who have a gift of insight into the secrets of the abnormal and the unexpected. Other species of cypripediums regularly bear more than one flower; this one may have done so in former ages, and here is the link that binds our pretty unifloral species to its remote and possibly extinct ancestor. On the other hand, a double-flowered form is possibly in embryo, and before the next century closes the *Cypripedium acaule* Ait. may need to have its description changed so as to embrace two flowers.

The influence of moisture, heat, and light is very great upon vegetation, and one only needs to observe the same species of plant as grown in a moist, shady place, as compared with the ones that are located in the full sun where the soil is dry. Size and shape of parts, and even their color and the surface, are different, and this all leads us up to the cultivated plants where variation is the rule and constancy the exception.

Among wild plants where similar surroundings obtain for all members of the species the albino is noted, and any replacement of stamens by petals, as in the wild buttercup, is the rare exception. But the cultivated plants have led a charmed life, and we scarcely wonder that the plants in the bed of sweet peas or gladiolus, canna or dahlia, are as diverse in form and color as the pieces in a crazy-bedquilt. Man, with all his ingenuity and skill, has been at work molding the plant clay made plastic by generations of special culture.

In one sense the greenhouse, the garden, orchard, and even the cultivated field are all dealing with monstrosities. The well-filled horticultural hall at a State or county fair is a vast collection of unnatural curiosities—that is, they do not occur in Nature, but are truly the creations of the mind of man as worked out along lines of vegetable physiology and stimulated plant production. For dinner this very day the writer ate a slice of a modern watermelon. What a triumph of horticultural art was exhibited in that giant fruit, each seed of which was filled with the accumulated tendencies of a generation of high breeding! There was represented the influence of soil and selection, of crossing and of culture, until the wild melon, which none of us sees or cares to see, is gone and a special creation takes its place, with its great demands upon any one who would attempt to grow it to perfection.

Fig. 3.—A Twin-Flowered Cypripedium Acaule (Ait.).

The art of breeding might possibly have deprived it of seeds had there been some other convenient method for propagation, as is true of many of our tree fruits, the navel orange being a striking example. Along with the absence of seeds and the presence of fine flavor there is truly a monstrous form, in that one orange is within and at the "navel" end of the other.

Should we glance at some of our garden vegetables, as, for example, the cabbages in their various races, every one will be struck with the strangeness, to say the least, of the forms produced. In contrast with the head of the true cabbage, where leaf is folded upon leaf until a mass of metamorphosed foliage as large as a half bushel is produced, there is the cauliflower, with the edible substance stored in a fleshy inflorescence that has lost its normal function and become truly monstrous. Were it not so tender and delicate a food we might be disposed to smile at the absurdity of the whole thing, or at the kohl-rabi, with its turniplike bulb in the stem just above the surface of the ground. It is certainly a plastic species that will give such diverse and fantastic forms—so far from the wild state, and for that reason so useful to man.

In the same manner a comparison of our orchard fruits with the forms from which they came would lead to the thought that man has made them to his liking, and not for service to the plant species. They are abnormal, judged by all standards in Nature; monstrous in size and in many cases have lost their essential structure as seed-producing organs.

Coming to the ornamental grounds, the disguises are largely swept away, and there is but little hope of judging what the original plants may have been from which have descended the favorites of the flower bed and the conservatory. Species have been split into a thousand and one varieties, each with its peculiarities and each with the potency for greater deviation. Where shall we cast the line and land an example? The rose show of June is only surpassed by the chrysanthemum exhibition in autumn. There must be the new sorts brought out each year, whether the fancy be for a special shade or color or a striking new shape of bud or form of bloom. Would you realize what a novelty means to those in the craft who watch a group of carnation growers as they hang over the exhibit of a "new" rival, and consider all the merits and defects of the candidate for a certificate?

All the beauties of the flower garden are so familiar to us that it is not expected that they will be considered unnatural. If the hydrangea makes a panicle larger than it can bear, man helps it out with a string or stake, for by overdoing it is not undone any more than is the coddled peach tree held up at fruiting time by a dozen poles, or the forced lily with a weak back supported upright by an artificial green stem at church on Easter morning.

But even here there are monstrosities in the true sense. The asparagus or sweet potato stem occasionally broadens out into a ribbon, and it passes as an abnormity. The same thing takes place in the flower cluster of cockscomb (*Celosia cristata*), and if it failed to produce a strange fan-shaped and highly colored and crested top the owner would complain that her seed had given her

Fig. 4.—Monstrous Blossoms of Foxglove.

only an inferior pigweed, and therefore not come true to name. The attractiveness of the cockscomb resides in the strange habit the plant has of broadening the upper end of the flower stalk out into a form that is truly monstrous. And this brings me to speak of a form that attracted my attention during the present season, samples of which are shown in Fig. 4.

The striking feature of the specimens of foxglove (*Digitalis purpurea*) under consideration is the production of an enormous somewhat bell-shaped flower at the extremity of the long racemose inflorescence, and at a time when only a few of the lowermost blossoms upon the stem have opened. The normal digitalis flower has a large pendant purple corolla much spotted upon the middle lobe of the larger and lower lip. On the other hand, the truly monstrous flowers, two to three inches across, are borne terminally and are quite uniformly bell-shaped, with the lobes from twelve to fourteen and spotted evenly over all the surface. The four stamens of the normal flower have increased to twelve in three examined and to thirteen in another. These stamens are normal in size and situated upon the corolla tube, except that there is no indication of their being in long and short pairs.

The single pistil is many times enlarged in the monstrous blossom—in one instance two thirds of an inch in diameter for the ovary. Within the outer ovarian wall there was a circle of five petaloid pistils, some showing the placentæ and ovules intermixed with the pink and purplish petaloid expansions.

Within the circle above mentioned there was a second pistil, tipped like the original with petal-like lobes instead of a stigma. The column was found so closely built up that the parts would not separate, and a cross-section was made through it, which showed that the pistil had a greenish central stalk around which the ovarian cavities were scattered quite irregularly, all bearing numerous ovules. In the flowers with twelve stamens there were four tips to the stigma, and the eight cavities were to be distinguished in the ovary, although they were not arranged in any regular order and not uniform in size. In short, the transections of these resembled the seed cavities seen in a slice of a large tomato of the "trophy" or "ponderosa" type.

The florists' catalogues advertise in a few instances this "*Digitalis monstrosa*," and it is presumed that the specimens from which the engraving was made were from a packet of this "strain" of seed. As but a small percentage of the plants in the bed examined were monstrous, letters were addressed to some German growers of the seed, with questions as to this commercial monstrosity. One reply contained the statement that the form known as "monstrosa" had been in the market about ten years, and that about fifty per cent of the plants produce the strange terminal flowers. Another correspondent recalls the form in question as having been catalogued for more than forty years, and that it is described in a work upon gardening published in 1859, in which it states that the seed of this variety must only be gathered from the capsules of the monstrous flowers in order to preserve the abnormity. Concerning this last my correspondent said that it is all the same whether the seed is taken from the capsules of monstrous flowers or from the whole spike. Seed taken in this way will give from twenty-five to thirty-five per cent of the monstrous flowers, but the ratio varies from year to year.

There are some advantages to the floriculturist in the monstrous form as the first bloom in it is uppermost and very conspicuous, while in the normal form the blooms appear from below upward, and the drooping tip of the spike is the last to produce flowers. The case in hand is a remarkable deviation from the type in many ways, but most interesting of all is the fact that floriculturists have by selection developed a variety that, in a packet of a hundred seeds, is quite certain to give some plants of the type "monstrosa," which it bears as its trade name.

MALAY LITERATURE.

By R. CLYDE FORD.

THE Malay has a literature peculiarly his own, and in it comes to light all that subtle appreciation of Nature which marks him as a *Naturmensch*, but not a savage. This lore of his race he carries mostly in his memory, for to reduce it to writing has been, until recently, a task at once laborious and scholarly, and the ordinary Malay, living in the ease of perpetual summer, is neither. Still, there are dog-eared old manuscripts which circulate from one village or *campong* to another, and these are often read aloud in the evenings to eager companies. And it makes a scene never to be forgotten, to see a dozen people seated in the shadows around some old man and to listen to the mellow cadences of his voice as he reads to them a tale of the olden time, of the great days of his race, before the foreigner's ships had scared the fish from the bays or turned them into noisy harbors; the sparkling stars peep through the ragged, whispering fronds of the palm trees, the yellow light of the *damar* torch shines on eager faces, crickets chirp in the grass, and from afar comes the booming of the sea borne on the soft breath of the night wind.

Malay literature, like most literatures, has had an ancient and a modern period. In the former we behold a primitive people dominated by Sanskrit life and civilization, and naturally enough the literature of this time is mostly translations of Sanskrit poems and romances, or at least productions inspired by such, and full of allusions to Hindu mythology. Probably to this early time may be traced such works as *Sri Rama,* a free translation of the *Ramayana;* the *Hikayat Pancha Tantra,* an adaptation of the *Hitaspodêsa; Radin Mantri,* a history of the love affairs of a Javan royal prince; the *Shaïr Bidasari,* an epic; and several other such epics and romances.

One must not think that the language of these works is old-fashioned or obsolete, as Beowulf and Chaucer are to us, or the Niebelungen Lied in German. On the contrary, they are full of Arabic words and many other marks of recent composition; but it is the matter, the conditions of life described, the evident antiquity of the very feeling of the productions, that lead one to refer them to the early period.

There are also some works that are genuinely Malay in origin and inspiration, and probably of a date that would put them between the ancient and modern periods. Of such is *Hong Tuah,* a story of a prince of Malacca who was a kind of King Arthur of his day. This work exists in several manuscripts, some of which are in England, one in Leyden, and one or two in the East Indies, and the date of the oldest is not before 1172 of the Hegira. Considering the fact that the year 1317 of the Mohammedan era does not commence till May 12, 1899, we thus see that many of the manuscripts of Malay literature are of no great antiquity. Another of these intermediate works is the *Sejarat Malayu,* or Malay Annals, which narrates the history of the Malays of Malacca, and their heroic defense against the Portuguese in the year 1511. It is divided into chapters, and is about the only notable historical composition in the language.

The modern period is that period which marks the domination of Islam in the far East, the period in which the Malay mind has adjusted itself to a new faith and a new education. It is hard to tell when Mohammedanism first obtained a real foothold among the Malays, but probably not much before the fourteenth century. However, the conquest when once effected was complete, and to-day the people of Tanah Malayu are among the strictest followers of the Prophet.

In a certain sense this period of the literature has been fruitful, but not so fruitful as the former one. Originality has been checked and imagination deadened, and the result is seen in a loss of sprightliness and vivacity. Works of morals and philosophy and compilations of Mohammedan law, have flourished. Still, we find some prose works of this period which are commendable; they even have some of the spirit of the earlier writings by which, no doubt, they were inspired; among these may be mentioned the *Tadju Elsalathin,* or Crown of Kings, by a mendicant monk, and the *Hikayat Sultan Ibrahim,* a religious romance of some beauty and pathos.

Within the last seventy-five years the prose literature has received some notable additions through the writings of Abdulla bin Abdulkadir, a famous *moonshi* of Singapore, who atained to some distinction under the Straits Government, being sent once or twice on missions to native states. He was born in Malacca toward the close of the last century, of Arab-Malay parentage, and received the ordinary education of a Malay lad of good family. After Singapore was founded, in 1819, he moved thither, where he thenceforth spent most of his life. His most important works are the *Hikayat Abdulla*, an autobiography, the *Pelayaran Abdulla*, an account of his trip for the government to Kelantan, and a narrative of his pilgrimage to Mecca made in the year 1854.

Without a doubt Abdulla was the most cultured Malay who ever wrote. In his capacity as teacher he was often called upon to help missionaries with their translations of the Bible into Malay; though a devout Mohammedan, he was more than ordinarily liberal in belief, and quite willing to see the contest between Christianity and Islam go on fairly and on its merits. He once assisted a Mr. Thompsen, of Malacca, in translating portions of the Scriptures, but it was a thankless task, for the missionary was obstinate, and thought he knew more about the language than the *moonshi* himself. As a result, such wretched Malay got into the work that Abdulla felt called upon in his autobiography to set himself right before the world. This is what he says:

". . . But let it be known to all gentlemen who read my autobiography that where there are wrong expressions or absurd Malay phrases in Mr. Thompsen's translation they must consider well the restraint put upon me, wherein I could neither add nor subtract a word without the concurrence of Mr. Thompsen. Now, because of all the circumstances mentioned here, let no gentleman rail at my character, for I was merely Mr. Thompsen's *moonshi* or instructor. I acknowledge I am not destitute of faults, but truly by God's grace I am able to distinguish between right and wrong in all that relates to the idiom of the Malay language, for I have made it my study. I did not attain it by hearing, nor by the way, nor in the bustle of the crowd."

But it is in poetry that we must look for whatever of originality and beauty there is in Malay literature, a fact not to be wondered at if we consider the softness and mellifluence of the language, which lends itself easily to the requirements of rhyme and rhythm. Two chief forms of poetry are recognized—the *pantun* and the *shaïr*.

The Pantun.—The *pantun* in Malay literature corresponds to the lyric verse of Western lands. It consists of one or many quatrains, as the case may be, the lines usually from ten to twelve syllables in length. However, if worse comes to worst, the Malay poet with true poetic license suits himself in preference to others, and frequently employs as few as six or as many as thirteen syllables in a line. The length of a syllable is determined by tonic accent, but penult syllables not ending in a consonant are long, those ending in silent *i* are short. But here, too, the Malay often departs from theory, and his rhymes, instead of being always exact, are constructed for the eye and not for the ear; and as for the short lines, they have to be drawled out into a legitimate scansion. The lines are not written one below another as with us, but the second opposite the first, the third under the second and opposite the fourth, and so on.

The *pantun* is much employed in improvisation, the stanzas being recited alternately by the two taking part. To the Malayan mind the beauty of this kind of verse lies in the artistic perfection of each quatrain by which it is made to veil some charming metaphor, which in turn serves in the last two lines to point a moral or express some sentiment of love or friendship, depending on the allegory of the preceding. To illustrate:

Tinggih tinggih pokok lamburi
Sayang puchok-nia meniapa awan
Habis teloh puwas kuchari
Bagei punei menchari kawan.

Bulan trang bintang berchaya
Burong gagah bermakan padi
Teka tuan tiada perchaya
Bela dada, melihat hati.

The lamburi tree is tall, tall,
Its branches sweep the sky;
My search is vain, and o'er is all,
Like a mate-lorn dove am I.

Clear is the moon, with stars agleam,
The raven wastes in the padi field;
O my beloved, when false I seem,
Open my breast, my heart is revealed.

The waves are white on the Kataun shore,
And day and night they beat;
The garden has white blossoms o'er,
But only one do I think sweet.

Deeper yet the water grows,
Nor the mountain rain is stilled;
My heart more longing knows,
And its hope is unfulfilled.

In poetry of more pretentious style, and in improvisations also, each stanza contains a key-word or line which becomes the text, so to speak, of the next. As artificial and unnatural as this may seem, it is, nevertheless, an ingenious way of keeping the thread of one's discourse when other inspiration fails. The best results of Malay verse come from it. A beautiful example may be cited from the Asiatic Journal of 1825:

Cold is the wind, the rain falls fast;
I linger, though the hour is past.
Why come you not? Whence this delay?
Have I offended, say?

My heart is sad and sinking too;
O break it not—it loves but you!
Come, then, and end this long delay;
Why keep you thus away?

The wind is cold, fast falls the rain,
Yet weeping, chiding, I remain.
You come not still, you still delay—
O wherefore can you stay?

Adelbert von Chamisso, the German poet, who has another claim to fame, however—his scientific career was charmingly described in the Popular Science Monthly for December, 1890—includes in his published poems three songs, In Malay Form, for which he doubtless obtained inspiration during his voyage to the far East in 1815 to 1818. They are so faithful in spirit and style to their source that we can not forbear quoting one in translation. It is called The Basketmaker, and is in the form of a dialogue, each stanza having the usual "key" line:

The shower's gone by, the sun shines bright,
  The weather vanes now gayly swing;
We maidens here in merry plight
  Quick beg of you a song to sing.

The weather vanes now gayly swing,
  Through fire-red clouds the sun shines fair;
Right gay and quick to you I'll sing
  A song that's full of dread despair.

Through fire-red clouds the sun shines fair,
  A bird sings sweet and lures the bride;
Pray what concerns your dread despair
  To maidens fair and dear beside?

A bird sings sweet and lures the bride,
  A net for fishes there is spread;
A maiden fair and dear beside,
  A sprightly maiden would I wed.

A net for fishes there is spread,
The moth's wings burn in bright flame hot;
A sprightly maiden wouldst thou wed,
But thee the maiden chooseth not.

THE SHAÏR.—The *shaïr* is very different from the *pantun;* the latter is lyric, the former epic in its nature; the *shaïr* may be heroic or romantic, the *pantun* never. However, it employs the same measure as the *pantun*, but all the lines of each stanza rhyme, instead of by pairs, as in the quatrains of the lyric verse. It is to the *shaïr* that we must look for the really great works of Malay poetry, where some are bold enough to declare we may find passages of Homeric beauty. The most famous works of this nature are *Radin Mantri, Kin Tambouhan*, and *Bidasari*. The first two of these tell the story of the love of a prince of the royal house of Nigara for a maiden of his mother's court. It is a beautiful tale, abounding in parts of striking eloquence and pathos, and the characters are strong and well portrayed.

The *Bidasari* is the longest poem in the language, and typically Malayan. Its author is unknown, likewise the time and place of its composition. The only hint as to the writer is in the opening lines:

". . . Listen to this story of the history of a king in a province of Kambayat. A fakir has turned the narrative into a poem."

And again at the conclusion, where it says:

"This poem is weak and faulty because my knowledge is imperfect. My heart was troubled—for that reason have I written it. I have not made it long, because I was sad; but I have finished it and thereby obtained many blessings."

Internal evidence, however, indicates that the poem is old, of a time long before the Europeans first came to the East, possibly before the Mohammedan conquest. It shows plainly the influence of Hindu theology, yet in the customs and scenes described, and the mode of life and the manner of thinking, it is essentially Malay, and so worthy, perhaps, of a somewhat extended notice.

"There was once a king, a sultan, handsome, learned, perfect; he was of the race of noble kings; he caused the land of merchants and strangers to be swallowed up. From what people of his time say of him he was a valorous prince who had never yet been thwarted. But to-morrow and the day after to-morrow are uncertain." Such is the beginning of Canto I, as given in the French translation by Louis de Backer. The king marries, but just as joy and happiness are to be his, a griffinlike *garuda* sweeps down upon his land and ravages it. Terrified, the monarch deserts his throne, takes his royal consort and flees for his life. On the flight the queen gives birth to a child, which, however, must be deserted, much to the mother's grief.

In Canto II a rich merchant is introduced—a man whose goods and treasures are immense, whose slaves numerous, prosperity constant, but who, alas! is childless. One morning as he and his wife are walking by the side of a stream they discover a boat drifting near them, and in it a child of such radiant beauty that they are moved to adopt it.

The lord of the region is Sultan Mengindra, whose queen is beautiful, but unhappy, through constant looking forward to the day when she shall be displaced by some woman more beautiful than she. At last she has a costly fan made, and sends out spies to offer it for sale in every village and town, but not to tell its price. If they discover a woman of rare beauty they are to return and notify her.

In course of time the spies come to the old merchant's home, and see Bidasari, the handsome adopted child. After some delay she is brought to court, where she has to undergo much studied ill treatment from the jealous queen. By a subterfuge the girl escapes and is then removed by the merchant to a secret place in the desert.

Canto III tells how Sultan Mengindra goes to hunt in the desert, and there finds a sleeping beauty whom he awakens and consoles with the music of a *pantun.*

In Canto IV the story returns to the King of Kambayat. He and his queen have succeeded in reaching a distant part of their kingdom, but the fate of the young princess whom they so shamefully deserted oppresses them. Finally, the king's son, stirred by his mother's tears, sets out to search for this sister whom he has never seen. In his search he meets with Bidasari's adopted brother, who detects the resemblance between the young prince and his sister. Together they go to obtain audience of the sultan and Bidasari, who is now queen.

Canto V. Convinced that the story of the prince is true, Sultan Mengindra dissuades him from returning, but bids his minister write a missive in letters of gold and dispatch it at once, with presents and jewels, to the King of Kambayat.

In Canto VI we have the last chapter. The King of Kambayat receives the letter, which, however, makes no mention of Bidasari, and at once accompanies the messengers to Sultan Mengindra's court. He makes his entry into the strange capital with becoming splendor, and is received with great honor. The queen now makes herself known to her father, who is moved to tears. Banquets and great tournaments follow, and happiness pervades the court. The king returns after a time to his own land, but continues as long as he lives to send gifts and goods to his daughter and her royal lord.

THE COLORS OF FLOWERS.

By HENRI COUPIN.

MUCH might be said, from an artistic and poetic point of view, concerning the colors of flowers. It is in the corolla that they reveal themselves in their most minute delicacy. The tints so widely diffused among animals, even those of butterflies, are coarse as compared with them, and the painter's palette is powerless to reproduce them. They run through the whole gamut of the solar spectrum, even to its most minute details. Some naturalists have striven to establish a classification of them, and it will be convenient to be acquainted with their efforts, though they are not decisive and are somewhat artificial, like all classifications. We give one of the most ingenious of them:

Green.

Cyanic series.	Greenish-blue.	Yellow-green.	Xanthic series.
	Blue.	Yellow.	
	Blue-violet.	Yellow-orange.	
	Violet.	Orange.	
	Violet-red.	Orange-red.	

Red.

The type of the cyanic series is blue, and that of the xanthic series yellow. The first is sometimes denominated the deoxidized series, and the second the oxidized, but these designations have hardly solid enough foundations to be preserved. De Candolle, who publishes the table in his Vegetable Physiology, appends some interesting remarks to it.

It will be noticed by the inspection of the table that nearly all the flowers susceptible of changes of color, as a rule, simply go up or down the scale of shades of the series to which they belong. Thus, in the xanthic series the flowers of the *Nyctago jalapa* may be yellow, yellow-orange, or red; those of *Rosa eglantina* yellow-orange or orange-red; those of nasturtium from yellow to orange; the flowers of *Ranunculus asiaticus* present all the colors of red up to green; those of the *Hieracium staticefolium*, and of some other yellow *Chicoraceæ* and of some *Leguminosæ* like the lotus, become greenish-yellow when dried, etc. In the cyanic series the flowers of many *Boraginaceæ*, especially of *Lithospermum purpureo-cæruleum*, vary from blue to violet-red; those of hortensia from rose to blue; the ligulate flowers of the asters from blue to red or violet; those of the hyacinths from blue to red, etc.

There are, however, a few apparent exceptions to this rule. Thus, although the hyacinths usually vary only in the blues, reds, or white, yellowish varieties, indicating an approach to the xanthic series, are sometimes found in gardens. The auricula, which is originally yellow, passes to reddish-brown, to green, and to a sort of violet, but never reaches pure blue; and single petals occasionally give suggestions of both series in distinct parts of their surfaces.

Some surprise may be felt that white does not figure in De Candolle's table. This is because an absolutely white color does not seem to exist in any flower. The fact may be shown by placing some flowers supposed to be of the purest white, like the lily, the white campanula, or the wood anemone, on a leaf of clear white paper. It will be found that the white of the corolla is really washed with yellow, blue, or orange, according to what flower is taken. If the tint does not appear distinct, infusions of the corollas in alcohol will present tones unmistakably yellow or red, etc. White flowers are therefore flowers with tints appertaining to one of De Candolle's series, but albinized, as if they were etiolated. A small number of flowers begin white, and are subsequently colored under the action of light. The *Cheiranthus chameleo* passes from white to citron-yellow and a slightly violet-red; the *Ænothera tetraptera*, at first white, becomes rose and then almost red; the petals of the Indian tamarind are white the first day and yellow the second; and the corolla of the *Cobea scandens* comes out greenish-white and turns to violet the second day. The most remarkable plant in this respect is *Hibiscus mutabilis*, which Rumph calls the hourly flower, because it starts white, turns flesh-color toward noon, and becomes red at sunset.

In his recent work on Plants and their Cosmic Media, M. Costantin has some remarks concerning the precocity of various races and the tint of their flowers. Hoffmann made observations on this point for several years. He remarked, as the result of eight years' observation, that the common lilac with white flowers blooms on an average six days earlier than the normal form with purple flowers. This might be a curious anomaly with no bearing, but the more we advance in the study of Nature the more we perceive that all phenomena, even the most insignificant, deserve to be examined. Similar results have been observed in varieties of radish (*Raphanus raphanistrum*) and of saffron (*Crocus vernus*); in the former the white flowers expand on an average of sixteen days earlier than the yellow ones (twelve years of observation), and in the latter plant the difference is four days.

These changes of tint sometimes appear to depend on the temperature. Thus, the white lilac was obtained by horticulturists under the influence of a temperature of between 30° and 35° C. We can not, however, affirm that spontaneous races with white flowers originated in the same way as the white lilac. It will be enough to point out a few facts that may contribute to the guidance of persons who are seeking to learn the origin of these colored varieties. The *Papava alpinum* has a very stable variety with yellow flowers, which, according to Focke, has been observed in the polar regions, while the white varieties have been seen in Switzerland. The cultivation of the same species at Giessen, Germany, has made it possible to obtain specimens with white flowers by metamorphosis from specimens with yellow flowers, but it is impossible to say whether or not heat is the agent that produces the changes in these cases. The experiments of MM. Schübela and Bonnier have shown that flowers become darker without changing their color in high regions and in those near the pole; but this phenomenon is one of light and not of color. Be their origin what it may, these white and colored forms have remarkable fixedness.

It will be observed that black does not figure in the table of the classification of colors given above. Absolute black, in fact, does not exist in any flower. If some parts appear black, it is only because their tint is excessively dark. The black of the petals of *Pelargonium triste* and of the bean is yellow, and that of the *Orchis nigra* is a brown. Apparent blacks are, moreover, extremely rare.

The gamut of the reds is much more varied than that of other colors. The reds of the xanthic series are generally more lively-hued, carnation or flame-colored; those of the cyanic series present tints more nearly approaching violet. These two reds may furthermore give rose-colors, but a little skill will divine their origin. The rose of the hydrangea inclines to blue, while that of the rose tends rather toward yellow. Blue colors are the most variable, and readily pass to violet and red, but most frequently to white. The most tenacious hues are those of yellow, and we might affirm that the bright and glistening yellow of the buttercup may be said never to change. The paler yellows change more easily, but rarely pass to anything but white. Green flowers, not being readily distinguished from the foliage around them, need not be specially mentioned. They are believed to be much rarer than they really are.

Horticulturists are able, by cultivation, selection, and hybridization, to cause the colors of flowers to vary in considerable proportions. Not much is known of the laws of these variations, chiefly because gardeners who might tell botanists of them if they would have not the scientific spirit. We cite here what MM. Decaisne and Naudin * say respecting the variations of the color of flowers:

* Manuel de l'amateur des jardins.

"Change in this respect is effected in two ways: sometimes there is a simple discoloration, drawing the red, yellow, or blue tints of the corolla toward a more or less pure white; sometimes there is a radical substitution of one color for another. Flowers in which red or blue are the dominant tints are most subject to turn white, but the change may also be observed on some flowers that are naturally yellow, such as the disk of the daisy, the dahlia, and the chrysanthemum when those flowers suffer ligular transformation. Nothing, on the other hand, is more common in our gardens than white varieties of pink or of red roses, lilac, scarlet runners, larkspur, purple digitalis, Canterbury bells, etc.—in fact, nearly all plants with lilac, rose, red, purple, blue, or violet flowers. There are some flowers, however, in these categories the coloration of which is very persistent, and rarely fades perceptibly—as may be seen in the purple petunias, the hue of which does not lose its vivacity even when it is crossed with the white variety.

"The radical substitution of one color for another, whether over the whole corolla or only on some of its parts, in the form of spots, stripes, or variegations, is also of frequent occurrence, and is one of the sorts of modifications which horticulturists have used with great advantage. A considerable number of 'fancy' plants derive almost all their importance from the facility with which the liveliest colors replace one another, blend, and intermix in a thousand ways and in relative proportions of which nothing is fixed, so that we can not find in these collections, when they are well chosen, two plants out of a hundred that are exactly alike in the tone and distribution of their colors. These multicolored varieties, all the offspring of cultivation, are generally perpetuated true by cuttings, while the seedlings compensate for the uncertainty of what they will produce by the certainty that they will give rise to new combinations of colors. This is not the case with single-colored varieties, which, unless they are crossed with others, tend to perpetuate themselves through their seedlings. The yellow, white, and purple varieties of the four-o'clock, for example, when they are pure, reproduce themselves constantly; when crossed with one another they give rise to intermediately colored flowers, and more frequently to variegated ones."

Mr. Hughes Gibb observed, in the mild winter of 1897–'98, that flowers blooming out of season were liable not to have the same color as regularly blooming ones.

The cactus dahlia, usually red, has put out flowers almost orange and with exterior florets sometimes nearly yellow. On the other hand, these dahlias have often shown a marked tendency to return to the simpler form.

A species of nasturtium, habitually of a bright scarlet-red, has given in the cold frame late flowers of a bright yellow, a red band near the center of the petals remaining the only vestige of the normal color. In both cases the change of color began on the edges of the petals. The flower of the myosotis, normally bright blue, has become almost clear rose, without the slightest trace of blue; and a pure blue phlox has shown a tendency toward greenish-yellow.—*Translated for the Popular Science Monthly from La Nature.*

FOLKLORE OF THE ALLEGHANIES.

By FRANCES ALBERT DOUGHTY.

THE West Virginia mountaineer lives very close to Nature, and viewed from many standpoints the relation is characterized by pleasing amenities: juicy berries refresh him along the road; nuts drop into his path; "sang" (ginseng), which makes one of his sources of revenue, reveals itself to his eye as he follows the cows to pasture; a cool brook springs up to quench his thirst when weary of following the plow; pine knots are always within reach to make light as well as warmth; mud and stones easily combine in his hand to shape a daub chimney; and a trough dug out of an old tree furnishes a receptacle that is as good for dough at one end as for a baby at the other.

Often, however, this close relation to Nature assumes a war attitude, fierce and uncompromising. If hungry wolves no longer howl furiously at the back fence after nightfall, or gnaw at the log pens which secure the stock, and if panthers are seldom bold enough to spring at a horse's flanks as a man rides along in the daytime, bears are still numerous enough to devour a large number of sheep every year in spite of precautions, and they have a pronounced taste for sweet young corn. The living wrested from the soil in the short and changeable summer months must cover the winter's need as well; it is generally so scant and uncertain that the mountaineer feels a chronic discouragement toward agriculture as a pursuit and resource. He must depend on it, and yet as far back as he or his father can remember there has always been some reason why "a good crop" could not be made that year. The West Virginian lives in a large and thinly settled game preserve, but the fleet deer usually contrives to escape the hunter's chill wait in the autumnal dawn, the coy wild turkey is overshy of his lure, and the wary trout requires a very patient rod. In the long winter deep snows cover the fences, groups or "bunches" of cows and sheep often perish in the drifts, and the human prisoners in their cabins, huddling around the wood fires, are nearly always, as they express it, "short of" some article which would be considered a necessity in the average city home.

The varying, defiant, and incalculable moods and phases of Nature bring so many chances into the humble lot of the mountaineer that it is not surprising he should interpret her phenomena as having a distinctly personal import. Anciently, around Olympus the talk was of "omens," "auguries," and "fate"; dwellers along the chain of the Alleghanies to-day talk of "signs," "spells," and "luck," and these words held their significance for hundreds of years in the ancestral stock of the first settlers in the region, most of the folklore being directly traceable to a Scotch-Irish strain of blood. The mountain pattern taken far from cities probably differs little either mentally or physically from that of the colonial mountaineers. Even with the railroad traversing a limited area, and the influx of summer visitors during three months of the year, the only perceptible change wrought in the natives is a little sharpening of their wits from the barter of fruit and furs at the hotels in the extensive mineral-spring section. The Alleghany mountaineer, ignorant, narrow-minded, honest, brave, and hospitable, remains what he was when the eagle soared from the inaccessible eyrie above his head to be chosen as the tutelary genius of the unconquerable young republic. The chief distinction in the temperament of the sexes is that the men are frank and talkative, the women shy and uncommunicative. Beings approaching the legendary fauns and satyrs, clad in the skins of wild animals, are sometimes discovered by the solitary horseman in the wild mountain fastnesses; they gaze at him as an apparition from a strange world, never having seen a village or heard a railroad whistle.

There is a curious and persistent survival of the belief in witchcraft through this mineral-spring belt in West Virginia. To draw out the natives on this mysterious subject they must be approached sympathetically; if twitted with their credulity they will shut up like clams, for with all the simplicity of the unlettered their intuition often arrives at a correct understanding of the estimate placed upon them by more fortunate persons. When satisfied that he is not expected to pose as a "freak," but is met on the equal plane of human intercourse, the mountain story-teller seems to enjoy recounting the traditions and beliefs of his people and their forefathers. Leaving himself a loophole of escape, he is very likely to finish his yarn with—

"'Tain't that I believe them things myself. I know they ain't nawthin' but superstition; but I kin qualify that right round here, not many miles away, there's people that believes in witches."

In a little cottage on a much-traveled thoroughfare one woman admitted to me with bated breath, as though not quite sure her tormentor was dead, that she had been bewitched. Her account was given in these words:

"I kep' seein' an old woman with a cow's hoof in her hand; sometimes she was by my side an' sometimes she was there on the wall. At last she come up close to me, an' she was goin' to clap the cow's hoof over my mouth, but I slapped at her right hard an' she went away. She ain't never come again. Yes, I *know* I was bewitched."

A cow's hoof is a frequent accessory, and animals that are brought into the magic circle are always of a domestic character, completely subservient to the power of the witch.

It is noticeable that the exercise of witchcraft is generally ascribed to women; and that of witch mastery, the superior attribute, to men.

The form of a judicial process found favor with the Puritan temperament in old Salem, although by a grim mockery the verdict was decided in advance. The independent mountaineer likes to take the law in his own hands, as the following story illustrates:

"A farmer believed a woman was bewitching his stock. He drew a picture of her and set it up as a target; then he sunk a piece of silver in his bullet with an awl, *that being the charm for shooting a witch.* He aimed to shoot the picture through the heart, but fired a little too low. On that very day the woman herself fell flat on the ground, and a deep, awful hole was found in her side. From that minute she suffered extreme agony, and died in a week."

The narrator had heard this grewsome tale from his grandmother, who said that she had seen the hole.

One of the oldest inhabitants of Monroe County is responsible for the ensuing chronicle; he dates it in the "forties" of the present century:

"'Tain't so very long ago there was a woman livin' near the Sweet Springs who used to be always seen with a cap and bonnet on; nobody ever saw her without the cap. She was a hard, grim-lookin' monster. If anybody was watchin' to see her ontie her cap strings, somehow they never could see any more until the clean cap was on—now that's *so*, there ain't any mistake about that! When she come over here from Botetourt County the report followed her that she lived pretty close to a man whose chillun went to school, an' a calf had been in the habit of attackin' 'em an' bitin' em. The father concealed himself one day and was watchin' to catch the calf. On that occasion it come out an' attacked the chillun on a bridge across a little stream o' water. He ran and caught the calf and cut off his ears with a knife. They always believed that *the old witch had turned herself into that calf*, and so when she turned back into a woman she wore the cap to hide that she didn't have any ears. There was three sisters of 'em; it was reported they was all witches, possessed of some uncommon art. John and Harriet had two little pet pullets they thought a good deal of. The cap-woman wanted 'em; they just fluttered an' fluttered till they died. Her name was Nancy L——. Well, she wanted the carpenter to make her a piece of furniture out of an old dirty plank she had, an' he wouldn't do it. He said it was gritty and it would ruin his tools. Then she got mad and said, 'I'll make you suffer in the flesh for that!' One day soon after that he was at his hog pen feedin' the hogs, when suddenly he was struck down perfectly helpless, so he couldn't speak. He thought it was paralytic or rheumatism. In those days there was an old doctor in Staunton, Augusta County, who had a kind o' process to steam people and boil 'em in a big kettle, for rheumatism. He put sump'n fireproof, a paste or ointment, all over 'em, like the fireproof you put on buildings, an' boiled 'em an hour or two hours, as the case might be. The carpenter went to consult him, an' he put him in a kettle that was big enough for him either to stand or sit down in it; a collar was fitted tight round his neck so the hot water couldn't get into his face and eyes. The boilin' didn't seem to do him any good. When he got home he halted about for twelve months or more. First he felt a pain in his hip, and then he felt a pain by the side of his knee as if it was gradually workin' down; then one day there was sump'n jaggin' in the calf of his leg. He put his leg up on a bench and an old gentleman seen sump'n stickin' out. He took a pair of nippers an' ketched holt an' pulled out a big shirtin' needle. Hugh kept the needle as long as he lived, and he believed Nancy the old witch shot him with it. He halted on that leg the balance of his days. *I've seen the needle;* it's God's truth!"

A spice of profanity seems to have the virtue of embalming a witch story in the mountain memory. A rustic maiden who lives with her family on one of the loneliest hilltops in the Alleghanies, only to be reached on foot or horseback, makes this contribution to the folklore of the region:

"An old lady not far off had three daughters, and she was going to learn 'em to be witches. They had to sit on the hearth by the fire and take off their shoes and grease their heels so as to go up the chimney, and they were not allowed to speak. The mother was to go first and the girls were to follow. The old lady and the two foremost ones had all got up safe, but the last girl, when she was in a narrow place in the chimney, said, 'This is a d—d tight squeeze!' With that she fell back and was burned up."

The value of silence and self-control appears to be the only touch of morality in the witch logic. Manifestations of the black art frequently take place by or over running water. These characteristics are observed in another story from the same maid of the mountain:

"Two witches were going to rob a store in the night, and they took a young man with them as a partner. They put the greased witch cap on his head so he could go through the keyhole. They all started out, and presently they came to a river. They saw some calves in a field, and caught three of 'em; they mounted the two that were heifers and the boy got on the steer calf. They charged him of all things not to speak on the journey. The witches jumped the river on their calves without makin' a sound, but just as he was jumping across he cried out, 'That was a d—d good jump for a steer calf!' Well, they all went on, and when they got to the store they passed through the keyhole one after another, the young man too. They took all the money they wanted, but when the time came to leave he couldn't get out of the keyhole, because he had spoken, and the spell was broken. He was found in the store the next morning, and had to take all the punishment."

It is interesting to note as an offset to all these diabolic attributes and potencies that a firm faith exists in a beneficent Power back of them which under given conditions will prevail over evil. "God is always stronger than the devil" is the mountain way of expressing this dependence, and there are charlatans who take advantage of it by going about as "witch masters." One of these died a few years ago, and another farther back, an Irishman named "Mosey," is quoted yet for his successes as "master of all the witches and all the devils."

When the cows had been eating mushrooms and their milk became too bitter to make good butter, Mosey was sent for at once to "cure the witchcraft" and "take off the spell." He took his regular beat through his part of the mountain country once in a while. An old man who oscillates between the "White" and the "Sweet," selling canes, remembers him well. He tells of one woman's experience who "filed a complaint" that her cow wouldn't give much milk, and that the milk wouldn't "gether" for butter.

"'Woman,' says Mosey, 'your cow's bewitched, and badly bewitched!'

"'Can you do anything for her, Mosey, and what will you charge?'

"'Yes, I can cure her if you'll pay me five dollars and give me five pounds of butter to take home with me to burn in the fire to cap the climax and burn out the spell.'

"Then he want through his enchantments over the cow, and took the money and the butter home with him. One day when he had been drinking a little I asked him if he really burned all that butter. 'Divil a grain of it did I burn; I ate it with my pertaties.' It was on that same trip when Mosey was curin' the cow that a man who lived near by sent for him. 'I feel mighty quare, Mosey,' says he, 'an' I can't describe exactly how I do feel!' 'You're bewitched, sir,' says he, 'and badly bewitched!' (he always used those words). 'Faith, an' I'll try and cure ye! Have ye got any blue yarn about the house?' The man's wife went to look for some, and she came back with a hank of blue yarn. Mosey wound off enough of it to make a cord about the size of his finger; they twisted it together, he pretending to put some enchantments on it, and then he told the sick man to fasten it round his waist next to his skin. 'Don't you lose it on peril of your life,' says he, 'or you're a dead man!' 'Peggy, get a needle and sew it on me!' he says to his wife, an' she done it. He gradually got well—may be he'd a got well anyway. I can't vouch for that."

When asked if such things were still happening, the cane-seller replied:

"Not three weeks ago a woman thought her cow was bewitched because her butter wouldn't gather, and she het an old horseshoe hot and dropped it in the churn of milk. When she churned again the butter on that occasion gathered, and *it was the same milk* that was in the churn to burn the witch. You can put that down for June, '93."

The Potts Creek neighborhood is said to be a center for the witch superstition. It is also a favorite place for "bush meetings," to which the natives come from a distance in their wagons with picnic dinners of salt-risen corn pone and sliced bacon, and there they listen approvingly to fervid exhortations that are based on orthodox Baptist and Methodist doctrines. The West Virginia mountaineer is profoundly religious in temperament, and considers that he has scriptural ground for a belief in witchcraft.

PROF. H. E. ARMSTRONG has described how, by taking incidents from suitable story books, children aged respectively seven and a half, ten, and twelve and a half years were set to work to test the physical facts mentioned, and how, by the systematic use of the balance, measuring instruments, and simple apparatus, or even household utensils, a true spirit of scientific research was engendered. Evidence of the good effect was exhibited in the notebooks made by the children, which demonstrate clearly how well the juvenile investigators have mastered the scientific method of observation.

ORIGIN OF ANCIENT HINDU ASTRONOMY.

By the Count GOBLET D'ALVIELLA.

IT is manifest that India is indebted for some of its astronomy to the Greeks. Not that it had not astronomy and astronomers from an epoch anterior to the invasion of Alexander. It had, in fact, been necessary to make observations of the heavens in order to fix a calendar that would enable the sacrifices of the Vedic ritual in connection with the return of the seasons and the revolutions of the stars to be celebrated at the right dates. Further, the belief in astrology, or the influence exercised by the movements of the planets on physical phenomena and all the events of human life, would lead, in India as elsewhere, to the observation and anticipation of everything relating to the conjunction and opposition of the heavenly bodies.

The Rig-Veda has allusions to the phases and stations of the moon. The stations (*nakshatras*) consisted, according to a tradition preserved by the Brahmans, of twenty-seven constellations (afterward twenty-eight) which the moon was supposed to traverse successively in the course of its sidereal revolution. A lunar zodiac and a primary division of time into months were thus obtained. The moon, moreover, bears in the Veda the name of month-maker (*mâsakrit*). Each station was assigned a uniform length of 13° 20′ on the ecliptic, and a denomination, generally derived from mythology. The month, in turn, took its name from the constellation that had the honor of harboring the moon. Manon and the Djyotisha (a special treatise included among the Védângas, or commentaries on the Vedas) tell us that the year was composed of twelve months, the month of thirty days, the day of thirty hours, the hour of forty-eight minutes, all strictly sexagesimal subdivisions, like our own measures of time. The Djyotisha also teaches the art of constructing a clepsydra, or water-clock.

The adjustment of the solar year to correspond with the lunar year and of the two with the civil year dates from this period. The month was still composed of thirty days, but the solar years were grouped into quinquennial periods, in the middle and at the end of which the lunar month was doubled. Combining these quinquennial periods with the revolutions of the planet *Brihaspati* (Jupiter), which was calculated as occupying about twelve years, the Indian astronomers computed an astronomical cycle of sixty solar years. As the same cycle is found with the Chaldeans, where, according to Berosus, it was called the *Sossos*, we have to inquire how far Brahmanic astronomy was influenced by the systems which were originally formed in ancient Chaldea. The presumption of such an influence furnishes a simpler and more probable hypothesis than the effort to trace the earliest astronomical ideas of the Hindus, as M. W. Brennand has recently suggested, to a period when the ancestors of the Aryans, the Semites, and the Chinese were wandering together over the plateaus of central Asia!

We know now, from the cuneiform inscriptions, that the Chaldeans had, at a period far anterior to the entrance of the Aryans into India, invented a double calendar, solar and lunar, with intercalary periods; discovered the proper motion of the planets; calculated the return of eclipses; and constituted a double metrical system, decimal and sexagesimal; and, as was done, too, in India, had divided the circumference into three hundred and sixty degrees of sixty minutes each. It is impossible to draw the lines exactly between the astronomical discoveries which the Hindus borrowed from abroad and those which they drew from their own resources prior to the invasion of the Greeks, but we need in no case go farther than Mesopotamia for the source of the borrowed data.

The ancient literature of India contains observations of the positions or conjunctions of some of the stars that carry us back to positive dates in the history of the sky. The astronomers Bailly, Colebrooke, and Bentley, and, more recently, M. Brennand, have found notes relative to astronomical phenomena that took place in the twelfth, fourteenth, fifteenth, and even the twenty-first centuries B. C. Max Müller, however, advises prudence and reserve in accepting these calculations, some of which may have been afterthoughts, and others offer only apparent agreements.

In any case, the advent of Buddhism, by depreciating the religious practices and astrological speculations of the Brahmans, contributed to bringing on a decline of astronomy at the very time it was taking its most vigorous stand among the Greeks. We learn from a passage in Strabo that the Pramnai regarded the Brahmans as boasters and mad because they were interested in physiology and astronomy. Now, there really exists an ancient Buddhist treatise in which the predictions by the Brahmans of eclipses of the sun and of the conjunctions and oppositions of the planets, and their discussions of the appearance of comets and meteors, are treated as despicable arts and lies.

It was just at this age that Hellenic culture was developed in northwest India. It held astronomy, and astrology too, in great esteem. The Milinda Panda mentions the royal astrologer as one of the principal functionaries of Menander. No doubt there were, among the Gavanas (Ionians) of Taxila and Euthydêmia, minds versed in the knowledge of the principal cosmological systems formulated among the Greeks from Thales to Aristotle, and also acquainted with all the progress in the physical and mathematical sciences that had been achieved by the Alexandrian astronomers in the last centuries before Christ. To comprehend the extent of the influence of Hellenic science, we have only to inquire what Hindu astronomy had bcome again at the time of the restoration of the Brahmans in the sixth century A. D. Aryabhatta teaches the rotation of the earth around its axis; maintains that the moon, naturally dark, owes its light to the rays of the sun; formulates the true theory of eclipses; assigns an elliptical form to the planetary epicycles; and demonstrates the displacement of the equinoctial and solstitial points. Varâha-Mihira devotes himself especially to astrological labors, but also has the merit of having condensed into a vast encyclopædia the *Pantcha Siddhântikâ*, the principal astronomical treatises that were current in India. And Brahmazoupta is especially famous for his revision of an older treatise, the *Brahma Siddhânta*.

In the opinion of the most competent critics, these works, which are chiefly empirical methods of determining the positions of the stars, are inferior to those which the Alexandrians have left us. Yet, in matters relating to the measurement of arcs and to spherical trigonometry, they reveal a more advanced state of the science. It is impossible to determine at what period this new astronomical science was constituted in India. Some of its theories squarely betray their indebtedness to Greek science, as, for instance, that of the displacement of the equinoctial and solstitial points by a periodical vibration or tremor. We can also say as much of the solar zodiac, the names of the constellations of which strikingly resemble the Greek names in form as well as in significance, and the same of the names of the chief planets. Other expressions are found, notably in the works of Vahâra-Mihira, which indicate, if not a borrowing, a contact, at least, with the works of the Greek astronomy, of which Mr. Burgess gives a fairly complete list in his Notes on Hindu Astronomy and the History of our Knowledge of it, in the Journal of the Royal Asiatic Society. Among these terms, some are Greek words which have been utilized in naming constellations or astronomical measures; others have retained the special significations which they had in the works of the Alexandrian astronomers. It would certainly be an exaggeration to insist that the adoption of a foreign term of necessity implies the borrowing of the idea which it expresses. It is, nevertheless, probable that the Sanskrit writers would not have made use of so many of these exotic denominations if the ideas they represent had already found their expression in the languages of India.

Further, among the fine Siddântas which Varâha-Mihira collected and condensed as including all the astronomical science of his time, there are two, the *Romaka* and the *Pauliça*, the names of which suggest directly—the first the scientific culture of the Roman world, and the other Paulus, a celebrated Alexandrian astronomer of the third century A. D.*

We apparently find, likewise, the names of Manetho (fourth century A. D.) in *Manittha* or *Manimda;* of Spensippus in *Sporedjivadja;* and of Ptolemy in *Asoura Maya*, whom the *Sounya Siddhânta* designates as the founder of astronomy, and who another treatise says was born at Romakapouri, "the city of the Romans."

In this order of ideas the natives of India have never tried to deny their sources. The Gavanas, we read in the *Gargí Samhitâ*, are barbarians; but this science (astrology) has been constituted by them, and they must be revered as saints. M. Weber affirms that a treatise on astrology bearing their name, the *Gavana Çastra*, was reputed to have been written in the land of the Gavanas by the god Sourya in person, when, expelled from heaven by the resentment of his divine rivals, he came down and was born again in the city of the Romans.†

We find, further, that the Greek calendar appears to have survived Hellenic domination in northern India. General Cunningham, in 1862, read in the inscriptions of the Indo-Scythians the names of the Macedonian months Artemisios and Appellaios. Since then the names of two other months of that calendar—Panemos and Daisios—have been found in inscriptions in the Kharosthis character.

Another era of Grecian origin, that of the Seleucidæ, seems likewise to have furnished the Hindus their first historical computation.‡ It should be observed, in fact, that their most ancient era, that of the Mauryas, dates from the year 312 B. C., or the beginning of the era of the Seleucidæ. This had been adopted by the Grecian sovereigns of India, as is attested by a coin of Plato, struck in the year 166 B. C.

Beginning with the Indo-Scythians, India generally adopted the era of the Çakas, which began, not, as had been long supposed, with the expulsion of the Scythians, but with the coronation of their prin-

* The Romaka Siddânta employs, as a measure of time, the *Guga* of 2,850 years or 1,040,953 days, giving a tropical year of 365 days, 5 hours, 55 minutes, and 12 seconds, which is exactly the figure proposed by Ptolemy and Hipparchus.—*Burgess, Journal of the Royal Asiatic Society.*

† The term Romakapouri does not necessarily imply the city of Rome; the name was probably extended to Alexandria and perhaps also to Byzantium. In other writings we find the name Gavanapouri, the city of the Greeks (or Ionians), applied to Alexandria.

‡ Till then, the Hindus hardly seem to have sought for a common measure of time except for astronomical or mythological purposes.

cipal sovereign, Kanichka.* Nevertheless, the inscriptions offer still other historical computations, as, for instance, that of the Goup-tas era, which began in the year 240 of the Çaka era, and that of Vikramâditya, which was made to begin retrospectively fifty-six years B. C. Hence arise complications of a nature to make the task of paleography and history no lighter.—*Translated for the Popular Science Monthly from Ciel et Terre (from the author's essays on Classical Influences on the Scientific and Literary Culture of India).*

SKETCH OF WILLIAM KEITH BROOKS.

THE old problem of Nature *versus* nurture that meets us in studying the life history of any organism becomes especially interesting in dealing with the biography of men of eminence. Are their achievements the inevitable expression of the natural forces innate in them at birth, or the product of environmental influences, or some resultant of these two factors? And how much may we in each case assign to one factor or to the other?

These difficult questions naturally suggest themselves in glancing at the life of the subject of this sketch. Like so many men who have won prominence in comparatively new countries, he seemed, in an environment that had no apparent relation to his future, to grow from innate tendencies toward something not suggested by the circumstances about him, even to grow in opposition to the molding influences of these, and to conquer them. Later, however, we find him surrounded by influences that made a particular mode of self-expression easy, if they may not be said to have forced such expression. It was then that the casual observer might say that the circumstances made the man; yet, looking backward, we can trace the initiative in the man that led him into the congenial environment. A selection of proper environment to express Nature has been rightly claimed as a potent factor in all organic life; nurture, then, comes as a secondary power to mold, or rather to translate, the inherent power.

William Keith Brooks, the second son of Oliver Allen Brooks and Eleanora Bradbury, daughter of the Rev. Phineas Kingsley, was born in Cleveland, Ohio, in 1848. In 1877 he married Amelia Katherine, daughter of Edward T. Schultz and Susan Rebecca, daughter of David L. Martin. He has two children.

Brooks grew up amid the stimulating influences of a relatively

* M. Sylvain Levi has, however, lately reopened the question of the initial date of this era.

new country, where freedom of development was not so sharply restricted but that all paths of life seemed equally open to one who would work. As a boy he was not one of those precocious naturalists of the common sort whose collecting instincts find expression in the hoarding of dead animals or plants rather than the neater postage stamp; names and authorities, classes and species, neatly arranged mummies, were not his delight. At first there seemed no sign that zoölogy would claim him as a most ardent admirer. Yet he was fond of live things and their ways, and introduced into his home that most delightful microcosm, the fresh-water aquarium (so much neglected in this country), in which he could observe at ease the habits and slow changes of living things when their native haunts were not accessible. Such early interest in the essential wonders of livingness rather than in man's artificial classification of phenomena was thus prophetic of much of his later originality of thought and view.

He has never forgotten how much he owes to the instruction of the earnest and broad-minded teachers in the public schools of Cleveland.

His college life began at Hobart, where two years left a deep impression from an acquaintance with Berkeley's thought, gained in browsing in the library, and long treasured up to produce fruit in philosophic views of maturer years. Then at Williams College, where the notable Natural History Society was sending out its expedition across South America, his love of Nature matured and specialized for two years longer, until he received the A. B. degree in 1870. It was Williams also that later, in 1893, bestowed upon him the LL. D. degree. For him the completion of college life was truly the "commencement" and not the finish of his intellectual training. His strong trend toward pure science and abstract mental life forced him onward into post-graduate work. But this required funds, and America was not Germany; the struggle for existence was not here so intense that one might not win bread in many walks of life without special training, and parents did not need to extend the larval period of support for offspring beyond the completion of college life to gain for them a place in any rank, social or intellectual. Now, a rapidly increasing need for the Ph. D. degree as entrance to professional life, necessitating several years of post-graduate study, often forces parents to take up their share in the increased burden. Then, however, few were agreed as to the advisability of prolonging an unpractical life devoted to study beyond what seemed the maximum limit of unproductive preparation for life—the day of graduation at college. Beyond that the young man must make his own way as best he might. The subject of this sketch chose to work his way by his own unaided efforts into the fullest measure of academic training.

That was before the day of competition between universities, and there was no temptation to go here rather than there in order to live a semi-parasitic existence as scholar or fellowship holder.

First in his father's counting house, and then at a boy's school near Niagara, young Brooks bravely gained the means to pursue higher branches of natural history, and to devote himself to research. In the former position he realized how futile for him would be a life given to money-getting, and he palliated the uncongenial nature of that life by such abstract thought as seemed useful, one immediate result of which was the invention of a mechanical device for computing interest and discounts in sterling money, that had considerable circulation. This, though it scarcely indicated a stronger bias for mathematics than for Nature study, showed a latent possibility that was not to be developed. In the latter position, which brought him in close contact with the wonders of time action, so plainly read in one of Nature's books for the blind—Niagara Falls—he found food for thought, as well as a deep interest in the action of young minds. Here was much material for philosophical study of wood life too, as well as for growth of conceptions of the way to learn and to teach.

Free, after serving three years, to follow his genius, Agassiz's romantic venture at Pennikese drew this young naturalist, as it did so many of that epoch; and henceforth marine life, with its revelation of fundamental problems, fascinated him. Working on at Agassiz's museum, learning its collections by heart, absorbing from this center of American natural history and from its founder both stimulus and method, influenced deeply also by the unobtrusive teachings of McCrady and others who helped to make Cambridge the Mecca of naturalists, he was already an active contributor to the discussion of problems in the embryology of animals when he won his Ph. D. degree in 1875.

Quiet, diffident, slow to speak, leaving hasty action, too, for those of other constitution, with thoughtful brow and keen eye to look outward, as well as to regard inner thought, this young man with flowing beard was a noticeable person. At this time he was to be seen always accompanied by his faithful "Tige"; for, wiser than Ulysses, he shared all the hardships and joys of life with this loved companion.

Now he sought his true environment, and found it in the new university starting in 1876—the Johns Hopkins University. There he was appointed Fellow, an honor subsequently won by many who are well known to biological science, as W. T. Sedgwick, E. B. Wilson, K. Mitsukuri, A. F. W. Schimper, H. H. Donaldson, H. L. Osborn, J. McKeen Cattell, H. H. Howell, A. T. Bruce, E. S. Lee, H. F. Nachtrieb, W. Noyes, J. Jastrow, E. B. Mall, H. V. Wilson, C. E. Hodge, S. Watase, and T. H. Morgan. Like C. O. Whitman, in 1879, he did not enter upon the privileges of that position, but as instructor and associate became at once a guiding element in the new growth. In the freedom from old traditions, from fixed conventions and routines offered by this new university, this peculiar original mind found its best environment, and while the opportunity doubtless did much for the man, the man certainly reacted most favorably for the welfare of the highest ideals of his new home.

We find him at once outspoken in emphasis of the philosophical aspect of animal morphology, contributing thoughts upon "inductive reasoning in morphological problems," upon "the relation between embryology and phylogeny," upon "the causes of serial and bilateral symmetry," and upon the "rhythmic nature" of the cleavage of an egg. Yet this period was also, and pre-eminently, one of acquisition of hard-earned and detailed facts. The development of Pulmonates and Lamellibranchs, of Crustacea and of Medusæ, as well as of the marvels of Salpa's life history, became absorbing studies.

This great field of the morphology of nonvertebrates could be properly worked only with access to the marine fauna, and at that date there were few facilities for seaside study in America. A true disciple of Louis Agassiz, Professor Brooks saw the need of a marine laboratory, and devoted himself, as Dohrn did at Naples, to the accomplishment of an end so necessary for the advance of natural science. Encouraged by the aid of a few citizens of Baltimore, in 1878 there was started an experiment—"The Chesapeake Zoölogical Laboratory," at Fort Wool, Va., with Professor Brooks as director. With the absolute devotion of its director to research as example, and with the liberal aid of the trustees of the Johns Hopkins University, this laboratory became a most important adjunct to the university and a virile center of zoölogical study. So great was its success as a factor in the advance of zoölogical knowledge that the trustees bravely continued to support it whenever financial disaster did not rob them of the last penny. For eight years in the Chesapeake, or in the remoter waters of North Carolina, the station flourished; then, in 1886, we find the director, with a few enthusiastic students, venturing in a small schooner to the but little known Bahama Island, Green Turtle Cay, there to enlarge their experiences with such delightful realization of naturalists' dreams of the tropics as Haeckel experienced in his Journey to Ceylon. Subsequent annual expeditions to Nassau, the Bemini

Islands, and to various parts of Jamaica served as marked eras in the lives of many young naturalists who will not soon forget the contact with life thus obtained.

From these sources and from his connection with the United States Fish Commission, as director of the Marine Station at Woods Holl, Mass., in 1888, Professor Brooks drew inspiration and fact for the work and thought by which he is so well known to the working naturalist. There are few great divisions of the animal kingdom that have not excited his special interest and claimed his long-sustained labor upon the problems they express. Like McCrady, deeply fascinated by the *Hydromedusæ* and their wonderful changes, many smaller papers, as well as the Memoir of the Boston Society of Natural History, entitled The Life History of the *Hydromedusæ* and the Origin of Alternation of Generations, testify to his success in unraveling plots that thickened with new discoveries.

An early interest in the mollusca, shown by his doctor's dissertation upon the embryology of the fresh-water mussels, printed in part in the Proceedings of the American Association, 1875, continued to be expressed in his contributions to many problems in the embryology of the fresh-water Pulmonates, of Gasteropods, of Lamellibranchs, and of the Squid. The Crustacea also rightly claimed a large share of the attention of a philosophic naturalist, bringing him face to face with the rigid formulations of law which these creatures present. The discovery of the very exceptional method of cleavage in the egg of the decapod Lucifer, and the demonstration of the existence of a free Nauplius stage there (published in the Philosophical Transactions of the Royal Society in 1882), marked a most important advance in the morphological interpretation of all Crustacea, and brought its author to the first rank as an authority upon this much-studied group. Studying and capturing at Beaufort those phantom-like sand burrowers, the Squilla, gained him an insight into and an interest in this strange division of Crustacea that enabled him to undertake that difficult task, the description of Stomatopods collected by the Challenger Expedition —a task completed in 1886. The report, published in such a magnificent series as only the British Government could have consummated, is noticeable for the author's clear, free illustration of the creatures described and classified. In it we find a classification of the numerous, weird, glassy larvæ, agreeing with the classification of the adults and marking the success of the solution of the problem—the reference of chance collections of various stages of many species to their proper places in the life history of each species.

When the fever for ancestral trees had spread among naturalists in a much more virulent form than that endemic in Wales, and when the Ascidians were brought into line as ancestral vertebrates, it was no wonder to find Professor Brooks laboring upon these interesting creatures, but his work in this group started from a different point of view. As early as 1875, when studying in the laboratory of Alexander Agassiz, he contributed to the Boston Society of Natural History a description involving a most novel interpretation of the embryology of a remarkable Ascidian, Salpa. This form is known to many not naturalists as that beautiful animal chain which is sometimes so common in the clear waters of Newport Harbor as to be dipped up in every bucket of water, but more often not there at all. The female buds forth male branches and gives each an egg (which is fertilized to form a second generation of females). There is thus no alteration of sexual and non-sexual generations at all; and, with characteristic appreciation of a paradox, Professor Brooks subsequently emphasized the fact that the poet naturalist Chamisso, in discovering, in 1814, "Alternation of Generations" in Salpa, had discovered a phenomenon where it did not exist, though subsequently found common enough in many other animals. With the continuity of interest so marked in him, the life history of Salpa, as thus revealed, continued to be one of the living thoughts in Professor Brooks's mind for a long period of years, and, with the accumulation of material and results of researches afforded by his summer work, culminated in the monograph Salpa—a quarto of nearly four hundred pages and fifty odd plates—published in 1893, or after nearly twenty years of sustained interest in this complex problem. In this volume we find first a coherent view of the intricate life history of this animal illuminated by such metaphors as make the necessary technicalities both readable and thinkable. For instance, "A chain of Salpa may be compared to two chains of cars on two parallel tracks, placed so that the middle of each car on one track is opposite the ends of two cars of the other track, and each joined by two couplings to the car in front of it on its own track, and in the same way to the one behind it, and also to those diagonally in front of it and behind it on the other track." Again, in speaking of that startling process of egg development that makes the embryology of Salpa one of the apparently insoluble problems of this branch of inquiry, he says: "Stated in a word, the most remarkable peculiarity of the Salpa embryology is this: It is blocked out in follicular cells, which form layers and undergo foldings and other changes which result in an outline or model of all the general features in the organization of the embryo. While these processes are going on the development of the blastomeres is retarded, so that they are carried into their final position in the embryo while still in a rudimentary condition. Finally, when they reach the places they are to occupy, they undergo rapid multiplication and growth and build up the tissues of the body, while the scaffolding of follicle cells is torn down and used up as food for the true embryonic cells. An imaginary illustration may help to make the subject clear. Suppose that while carpenters are building a house of wood the brickmakers pile clay on the boards as they are carried past, and shape the lumps of clay into bricks as they find them scattered through the building where they have been carried with the boards. Now, as the house of wood approaches completion, imagine the bricklayers build a brick house over the wooden framework and not from the bottom upward, but here and there wherever the bricks are to be found, and that as fast as parts of the brick house are finished the wooden one is torn down. To make the analogy complete we must imagine that all the structure which is removed is assimilated by the bricks, and is thus turned into the substance of new bricks to carry on the construction."

Following that descriptive portion of the work comes a most interesting interweaving of facts gathered in wide experience with a scientific imagination possible only to one who had lived and thought in close sympathetic contact with tropical marine life. It is an account of the present conditions of life along tropical shores and the probable steps that led to the evolution of the innumerable sedentary and creeping things from the ancestral forms that floated on the surface of the ocean before there were shores. Charming reading for the layman, and for the specialist a broadening poetic insight into life as it is and as it was when the world was young and the pelagic forbears of the vertebrates competed with their simpler associates in the annexation of the bottom as a vantage ground for the "benevolent assimilation" of later immigrants. The third portion of the work follows a most commendable plan: "Scientific controversy is so unprofitable that I shall try to make it as subordinate as possible, that the reader may devote all his attention to the life history of Salpa, without interruption at every point where my own observations confirm or contradict the statements of others." This section deals with the refutation of criticism of the author's interpretations, and endeavors to harmonize the discords that in this, as in all complex morphological research, make progress slow though surer.

The above brief references to the research work of the subject of this sketch would be too incomplete did we omit mention of his papers upon that very interesting and extremely ancient inhabitant of the Chesapeake, the Lingula, or of the beautifully illustrated memoir of the National Academy of Sciences, describing the crania of the Lucayan Indians, an unfortunate race of gentle beings discovered by the Spaniards and treated as part of the live stock of the New World and soon annihilated, leaving but a few bones, and, as Professor Brooks tells us, our familiar and pleasant word "hammocks," as evidences of their having been.

Coming to maturity in the period of general acceptance of the Darwinian hypothesis of organic evolution, Professor Brooks was naturally deeply influenced, and no one who has read his works can doubt his allegiance to natural selection as a powerful factor in the formation of the present order of living things. In the American Naturalist for 1877 he published the first outlines of a provisional hypothesis of pangenesis that sought to "combine the hypotheses of Owen, Spencer, and Darwin in such a way as to escape the objections to which each is in itself liable, and at the same time to retain all that renders them valuable." In 1883 the same hypothesis—that variations are perpetuated chiefly through the male line by special gemmules, and that the female is essentially conservative—was elaborated in book form under the title of The Law of Heredity.

Thenceforth, in intervals of research work, Professor Brooks has contributed to various periodicals, notably the Popular Science Monthly, such essays upon kindred topics as spontaneously arose in his mind in connection with current work here and abroad. Some of these of a general philosophical interest have been incorporated with lectures, originally given to students in Baltimore, as The Foundations of Zoölogy, brought out this year by the Macmillan Company as Volume V of the Columbia University Biological Series. This, it will be noted, is dedicated "To Hobart College, where I learned to study, and, I hope, to profit by, but not blindly to follow, the writings of that great thinker on the principles of science, George Berkeley," and its keynote might be said to be difficult to hold, expressing the standpoint of one who says "The proof that there is no necessary antagonism between mechanical explanations of human life and belief in volition and duty and moral responsibility seems to me to be very simple and easy to understand."

Though thus active in pushing forward the limit of fact and theory in the domain of pure science, Professor Brooks has not shirked the duty that falls to every member of society, but has labored earnestly to build a sound basis for immediate practical application of zoölogical research. In 1876 he organized a summer zoölogical laboratory for teachers and others in Cleveland, with the co-operation of two other young Clevelanders—A. H. Tuttle, now Professor of Biology in the University of Virginia, and I. B. Comstock, Professor of Geology in the University of Arizona.

Identifying himself with the interests of the community in which he had cast his lot, he interested himself in the establishment of such educational influences as that of a public aquarium, and it was through no fault of the sower that the seed laboriously sown fell upon stony ground. In the winter of 1880 he gave a course of lectures and of laboratory work for teachers in the schools of Baltimore.

Again, his early studies of the development of the oyster (for which he was awarded the medal of the Société d'Acclimatisation of Paris in 1883), his discovery that the American oyster could be reared like fish from artificially fertilized eggs, since he found it to have a different life history from its European fellow, led him to realize the greater possibilities that awaited our oyster industries when they should be based upon scientific fact. Living amid a population dependent to no small extent upon these industries, Professor Brooks threw himself with enthusiasm into the problem of warding off the ruin that comes to every enterprise expanding faster than its capital is replenished, and eagerly sought the means to magnify without deterioration so important a factor in the existence of the Commonwealth. As chairman of the Oyster Commission appointed by the General Assembly of Maryland in 1882, he drew up the long, detailed, and well-illustrated report, issued in 1884, which set forth the condition of the oyster beds in the Chesapeake Bay and their deterioration from overwork, and suggested a legislative remedy in the form of a bill designed to remove this industry from that primitive, barbaric stage in which our communal ownership of migrant birds and fish still remains, and to place it upon the secure basis of personal ownership underlying other live-stock business. But it is difficult to change the customs of centuries' standing, and prophets rarely see the fulfillment of their predictions. Many lectures and the issue of a popular book—The Oyster, 1891—were necessary labors assumed by Professor Brooks before the public mind was educated to some appreciation of the nature of the problem, and the fruits of his labors are yet to be matured and gathered.

But it is not so much by discovery of new facts or by aid to the community in which one may chance to live that a man exerts his best influence upon mankind; rather by his success in inspiring others to see whatever of good there may be in his point of view and method of attack upon old problems, that his followers may keep alive and enlarge what he stands for in the growth of civilization. As a teacher Professor Brooks has exerted a powerful influence by the stimulus of example in his whole-hearted devotion to research, by originality of suggestion, and by his clear intuition of the essential factors in morphological problems. Convinced that naturalists, like poets, are born and not made—or, if so, then self-made—his teaching has been free from that too easily acquired hallucination that the forcible introduction of facts, and frequent extraction of words by means of examination, are a possible means to the making of zoölogists, or what you will to order, to be ticketed and branded as such after a fixed term of the above process. Those who are strong enough to grow in the open have found in him a genial sunshine, but those needing hothouse forcing have sometimes missed, perhaps, the care necessary to bring them to a marketable state.

Many who have followed his lectures will recall the clearness and simplicity with which complex and puzzling questions were presented to their minds; the skull of the bony fish soon lost its terrors, while the homologies of the limb bones were brought to the mind in a graphic way, sure to leave a deep impression. Directness and lucidity, with freedom from investment of unessentials, are characteristics of his teaching and prominent features in his too little known Handbook of Marine Zoölogy, which, despite technical faults, was so original and honest, so free from closet natural history, that it marked an era in the advance of biological instruction. It was a direct appeal to the concrete study of living animals at a time when zoölogy for students was still the learning of text-books, and text-books were too often in spirit but modernizations of Pliny or of Aldrovandus.

It is this removal of the impeding paraphernalia of custom-bound authority, and a direct, childlike communion with Nature in search of truth by one's unaided labor, that this man has to offer to those who come under his sway as teacher; with what success will be evident from the work of those who recently united to honor his fiftieth birthday with a portrait that might recall him to them as he taught them, and from the work of those who, in coming years, will enjoy the privilege of contact with his genius and be led to "seek admission to the temple of natural knowledge naked and not ashamed, like little children."

FORESTRY, Professor Fernow said in his paper at the American Association, is not, as it seems to be popularly believed, "Woodman, spare that tree," but "Woodman, cut those trees judiciously." The handling of a slowly maturing crop like forest trees requires especial consideration of a problem quite unlike any other that presents itself to the business man. The trees ripen slowly, a full century often being necessary to the complete development of growth. Obviously it would be inadvisable to cut down the product and then wait a hundred years for further income from the land; another system is necessary, where merely the interest is taken, in trees which are in a condition to cut, while the principal, the forest itself, remains always practically intact.

Editor's Table.

PRIMITIVE MAN.

TWO articles contributed to the April and May numbers of the Fortnightly Review by Mr. J. G. Frazer, the learned author of The Golden Bough, and more recently of a monumental edition of Pausanias, are worthy of the close attention of all who are interested in the early history of mankind. The articles are entitled The Origin of Totemism, and the object of the writer is to show that on this obscure subject a flood of light has been shed by the lately published researches of Messrs. Spencer and Gillen into the beliefs and practices of the native tribes of central Australia, those tribes being perhaps the best representatives now anywhere surviving of the most primitive condition of the human race. Mr. Baldwin Spencer, formerly a Fellow of Lincoln College, Oxford, is at present Professor of Biology in the University of Melbourne, while Mr. Gillen is a special magistrate in South Australia, charged with the protection of the aborigines. In their work, Mr. Frazer observes, "We possess for the first time a full and authentic account of thoroughly primitive savages living in the totem stage and practically unaffected by European influence. Its importance," he adds, "as a document of human history can, therefore, hardly be overestimated."

Evolution, it has often been remarked, and is again remarked by the writer of these articles, is an outcome of the struggle for life, and is rapid and vigorous or slow and feeble, according to the intensity of the struggle and the number and variety of the competing elements. Among the great land masses of our planet Australia is the smallest; and, owing to this circumstance, and also to its physical conformation, which renders large areas unfit for the maintenance of life, population has been much restricted and competition has been at a minimum. Hence the extremely backward and undeveloped condition of its native tribes, a condition which enables us, as Mr. Frazer observes, to detect humanity in the chrysalis stage, and mark the first blind gropings of our race after liberty and light.

The account given of these tribes contains indeed some very remarkable details. For example, "though they suffer much from cold at night under the frosty stars of the clear Australian heaven, the idea of using as garments the warm furs of the wild animals they kill and eat has never entered into their minds." They attribute the propagation of the human race wholly to the action of spirits, to whom they attribute a fecundating power, treating as wholly irrelevant to the matter any contact of the sexes. The idea of natural causation seems to be one which they have no power to grasp. They believe that various results are dependent on special antecedent conditions, but it is a pure matter of accident what they shall conceive the conditions in any case to be. Here we come to the origin of totemism. Heretofore totemism has been considered, broadly speaking, as the identification of themselves by some group of savages with a particular plant or animal or other manifestation of the powers of Nature, accompanied by a complete or partial *taboo*, so far as the group in question is concerned, of the animal or other object adopted as totem, and also by a rule prohibiting marriage within the group. What Messrs. Spencer and Gillen have succeeded in doing has been to observe and detect the significance of certain practices of the Australian tribes which have never been observed, or at least never understood, before.

At a certain time of the year, it appears, each totemistic tribe goes through elaborate ceremonies of a purely magical character for the purpose of promoting the growth and multiplication of the particular animal or plant, if it be one useful for food, with which the tribe is identified, or of antagonizing its evil effects if it be of a hurtful character. As "there is scarcely an object, animate or inanimate, to be found in the country occupied by the natives which does not give its name to some totemic group of individuals," the general scheme of things is pretty well looked after in the various ceremonies that are practiced by the different groups. Attention is here drawn to the essential difference between religion and magic, religion being an attempt to propitiate or conciliate the higher powers, while magic undertakes to coerce them. "To the magician," as Mr. Frazer observes, "it is a matter of indifference whether the cosmic powers are conscious or unconscious, spiritual or material; for in either case he imagines that he can force them by his enchantments to do his bidding." The ceremonies of the native Australians, as we have said, are wholly magical. They have the same kind of faith in their incantations and other strange performances that the modern man of science has in the preparations he makes for a physical experiment. The difference is that imagination or the crudest kind of symbolism has suggested the methods of the savage, while a careful scrutiny and comparison of facts has dictated those of the man of science. The *proprium* of the savage mind is an utter insensibility to evidence, or rather a lack of all power of conceiving what evidence is, and therefore a total incapacity for feeling any need of it. The scientific man, on the other hand, feels that he needs it every hour and every moment.

It may be interesting to quote the description given by Mr. Frazer, after Messrs. Spencer and Gillen, of the ceremonies performed by the men whose totem is the "witchetty grub," a creature much prized as an article of diet by the natives.

"The men of the witchetty-grub totem repair to a shallow cave in a ravine where lies a large block of quartzite, surrounded by some small rounded stones. The large block represents the full-grown grub; the small stones stand for the eggs. On reaching the cave the head man of the totem group begins to sing, while he taps the large block with a wooden trough, such as is used for scooping the earth out of burrows. All the other men at the same time tap it with twigs of a particular gum tree, chanting the while. The burden of their song is an invitation to the insect to go and lay eggs. Next, the leader takes up one of the smaller stones, representing an egg, and strikes each man in the stomach with it, saying, 'You have eaten much food,' after which he butts at the man's stomach with his forehead. . . . Ceremonies of the same sort are performed at ten different places. When the round has been completed the party returns home. Here, at some distance from the camp, a long structure of boughs has been got ready; it is designed to represent the chrysalis from which the full-grown insect emerges. Into this structure the men, each with the sacred design of the totem painted in red ochre and pipe clay on his body, enter and sing of the grub in the various stages of its development. After chanting thus for a while they shuffle out of the mock chrysalis one by one, with a gliding motion, singing all the time about the emergence of the real insect out of the real chrysalis, of which their own performance is clearly an imitation."

The Emu men have their own ceremonies, equally elaborate and quite as well adapted to promote the multiplication of emus as those of the witchetty-grub men to produce an abundance of witchetty grubs. The earnestness which is thrown into these ceremonies is beyond all question; and it seems to be clear that each totemic group in turn takes up its own burden of social responsibility: each has its duty to the tribe as a whole, and performs it to the best of its ability. Through their united efforts, as they firmly believe, the various processes of Nature are maintained in satisfactory activity; the succulent grub comes forth in due season and in reasonable quantity; the emu, the kangaroo, the bandicoot, and other useful animals keep up their numbers and continue to furnish food for the community; the hakea flower and the manna of the mulga tree grow in normal abundance; the winds blow; the streams flow; the clouds yield rain and the sun goes on shining by day and the stars by night, with, on the whole, an admirable regularity. A more satisfactory system it would really be difficult to conceive. How absurd, not to say profane, it would be for any one to suggest that ceremonies which were so abundantly justified by results might without danger be omitted! Skepticism is indeed very much out of place in certain stages of human development.

The interesting feature, however, as Mr. Frazer holds, in the descriptions given by the two Australian writers we have named is the proof they afford that totemism, instead of being an irrational, unexplainable aberration of the nascent intellect of man, was really a scheme for securing the greatest possible multiplicity of benefits for the savage community. The whole tribe was divided into groups, and each group undertook to look after some function of Nature and keep it up to the mark. Here was a notable step in the direction of division of labor. How it came about that the particular animal or plant which was the totem of a group became wholly or partially *taboo* to the group is not very easily explained; but it seems not impossible that some sense of tribal duty, gradually developed, kept those who were credited with providing any particular food element from being themselves greedy consumers of it. So far as that article was concerned they may have felt themselves as sustaining somewhat the character of hosts or entertainers of the tribe, and it may thus have became the custom that they should either not partake at all of that special thing, or partake of it only sparingly. If so, we find the foundations already laid both of politeness and of morality. It is an interesting question how far the notions which have been described have died out of modern civilized society. That they are wholly extinct it would be rash to affirm. There are many traces, indeed, of the surviving influence of symbolism, and here and there lingering tendencies toward a belief in magic are easily discoverable. Perhaps the wisest of us may learn to understand ourselves a little better by studying the operations of the human mind in its very earliest stages, before reason had yet shaken itself free from the random suggestions of sense.

THE BOSTON PUBLIC LIBRARY AND SCIENCE.

Apropos of the recent notable issue, by the Boston Public Library, of a comprehensive Bibliography of the Anthropology and Ethnology of Europe, to accompany Professor Ripley's Races of Europe, the twofold and diversely opposed interests of a great institution of this sort are called to mind. On the one hand are its manifold obligations to the great mass of the public, to the average reader, to the ubiquitous novel and fiction consumer, to private clubs, and to school children. A field of activity and value in popular education is involved, scarcely secondary to that of the public schools, appealing to the general reader, the taxpayer, and, above all, to the well-wisher for democratic political institutions and representative government in the future. In stimulating work of this character in Boston, in bringing the Public Library into deserved prominence among the educational institutions of the community, Mr. Herbert Putnam achieved great and deserved success during his administration, winning commendation upon all sides.

The second aspect of public library duty is revealed by the recent undertaking at Boston above mentioned. It concerns the relations of great libraries to science, to original research, not to the average reader, but to the specialist. Instead of the purchase of twenty copies of David Harum, or perhaps of A Bloodthirsty and Self-laudatory History of the Recent Spanish War, by One who killed fifty men with his own hand, to meet a sudden demand on the part of readers, the expenditure of perhaps an equal sum of money for some rare and costly work in a foreign language, intelligible to but half a hundred men in the entire city, is involved. Such obligations do not of course rest upon libraries of secondary size and importance. Their path of duty is clearly marked out for them in the interests of the public, both on the score of financial ability and of demand as well. With the leading libraries of the country the case is different. Our universities are fast taking rank with the very best in Europe. Specialists in science and technology, the peers of those abroad, are plentiful on every hand. Oftentimes their private means are as limited as their appreciation and ambition are great. Without these rare books—the tools of their trade—they are powerless. In former days they were denied the opportunity for research, or else were obliged to spend months of study in Europe. We have the men and the minds here in America now; there is every indication that the books and apparatus are speedily becoming available as well.

This Bibliography of the Boston Public Library is a case in point. A collection of works relating to the physical history, the origins, migrations, and languages of the peoples of Europe is indicated upon its shelves, in all probability, we venture to predict, superior to any single one existing in Europe. This startling statement is based upon several considerations familiar to any specialist. Scientific book materials are of two classes. The first are the expensive and compendious volumes, generally to be found in great libraries, although oftentimes the paucity of their scientific collections is very surprising, especially in all that concerns the newer sciences of biology, anthropology, and the like. The second order of publications, often rarer and scientifically more valuable than the first, are the scattered monographs or pamphlets published in all manner of forms and by societies, oftentimes ephemeral and of all degrees of eminence. This second class of materials is generally richly represented in the collections of the various scientific societies, especially in the form of reprints presented by the authors. But the great and expensive tomes are seldom thus presented, and the societies can seldom afford to purchase them. Thus it comes about that these two classes of raw materials have to be separately hunted down, being rarely found together. For example, the library of the Société d'Anthropologie at Paris, judging by its printed catalogues, while abounding in scattered monographs and reprints, contains very few of the expensive volumes. One must seek these, and if they be in English or German, very likely in vain, in the Bibliothèque Nationale.

The Public Library of the city of Boston has apparently tried an experiment in this direction, and is certainly to be congratulated upon the result. To a very rich collection of standard works has been added, by co-operation with a special investigator, a large part of the *flotsam* and *jetsam* which is of such extreme value to the student of original sources. The library has set a worthy example of encouragement to research; it has offered definite proof of the ability of our American institutions to rival their European contemporaries. And a peculiarly appropriate rounding-out to the successful career in the distinctively popular phases of administration of the institution of the late librarian, Mr. Herbert Putnam, is afforded in this work, the last at Boston officially, perhaps, to bear his signature and the stamp of his approval.

OUR RACE TROUBLES.

The article which we publish in the present number of the Monthly, under the title of The Race Problem in the United States, is a sequel to one which appeared in the May number entitled The Negro Question. Both writers have a special acquaintance with the subject, and are widely known as active workers for the elevation of the negro race—Mr. Booker T. Washington, the writer of the second article, being himself one of its most distinguished representatives. While both manifest abundant sympathy with the negro, and a deep sense of the pressing nature of the problems to which the presence of a large negro element in the population of certain of our States gives rise, they virtually acknowledge that it is extremely difficult in discussing the subject to do more than present a few broad general views. That there is a very bad condition of things in some of our Southern States no one will dispute. The crimes which have been committed by white men, in avenging real or supposed crimes committed by black men, stamp a character of utter savagery on the communities in which they have occurred, and in which they have remained unpunished. At the same time there is no doubt that the existence of so large a negro element in the South constitutes a serious obstacle to the moral and intellectual as well as to the economic development of that part of the country, and tends to keep alive a dangerous condition of public feeling. Our contributor, Dr. Curry, states significantly that he could give very impressive details on this point, were it not that it would furnish altogether too unpleasant reading.

What are we going to do about it? No doubt we have before us an illustration of the old adage, "The fathers have eaten sour grapes, and the children's teeth are set on edge." The South had its "peculiar institution" for some generations, and held to it with extraordinary tenacity—went to war rather than give it up. Now, by the simple force of events, the old patriarchal and slaveholding system is broken up, and there the former slaves and their descendants are—emancipated citizens who have their rights under the Constitution, and who therefore have to be reckoned with. They can not be deported against their will; they have the same right to live in the country that any white man has.

Manifestly there is but one honorable way of dealing with the blacks, and that is to treat them with absolute justice. Upon this point we are in entire agreement with Mr. Booker T. Washington. If a black man is excluded from the suffrage on account of his ignorance, let the equally ignorant white man be equally excluded. We have great faith in the educative effect of justice, and a firm administration of law. It would at once raise the self-respect of the negro to know that what was law for the white man was law for him, and *vice versa;* and self-respect is a sure ground for further advance. In the matter of education, we hold that education for the colored race should be almost wholly of a practical kind. We go further, and say that the education given to white children everywhere might with great advantage be much more practical than it is. The proper education for any individual is that which will tend to make him more efficient, successful, and self-sufficing in the position which he is called to occupy. This principle, far from implying a stationary condition of the individual, is precisely the one which provides best for his advancement. It is the man who is thoroughly competent for the work he has at any given moment to do who passes beyond that work to something better. The misery of existing systems of education is that to so large extent they educate for a hypothetical position beyond that for which an immediate preparation is necessary. The result is that the schools unload upon the community year by year a levy of adventurous youths who at once begin to live by their wits in no very creditable sense, and who constitute a distinct menace to the stability of society.

We would therefore urge most earnestly upon all who take an interest in the education of the colored race to keep in view above all things the importance and necessity of fitting the negro to take an active part in the practical industries of the country, and above all in agriculture. An education directed mainly to this end would do far more to develop his intelligence than one of a more abstract and ambitious character and would furnish a far better foundation for success in life. Far from tying the negro down to manual occupations, it would prepare the way for his eventual participation in all occupations. But occupation for occupation, where is there one that can reasonably be rated higher than the intelligent and successful cultivation of the soil? If the negro problem can not be solved by common sense and common honesty it can not be solved at all. Before giving it up as insoluble we should make full proof of these homely specifics. We have long been proclaiming that the negro is a man and a brother; let us therefore treat him as such, and if we find out anything that is particularly good for his moral and intellectual improvement, let us try a little of it ourselves. It surely will not do us any harm.

Scientific Literature.

SPECIAL BOOKS.

The Lesson of Popular Government * is a fruit of thirty years' study, by Mr. *Bradford*, of certain peculiarities in the political workings of our institutions. The book is not for those who consider it patriotic to shut their eyes to whatever is going wrong, but for those whose regard for the Federal Constitution and the organization of our governments is only in-

* The Lesson of Popular Government. By Gamaliel Bradford. New York: The Macmillan Company. Two volumes. Pp. 520 and 590. Price, $4.

creased by the consciousness of the strain to which they are exposed, and who feel strongly that while the principles of the Government and the character of the people "are still sound and reliable, some modifications and readjustments of the machinery must take place, unless we are to drift through practical anarchy and increasing corruption to military despotism." For the sake of putting the subject in a clearer light, the three more prominent approaches to democratic government in modern times—those of England, France, and the United States—are studied comparatively in the former part of the work. The carrying on of governments in accordance with the expressed wish of the people is spoken of in the beginning as the appearance of a new force which has changed the whole face of society, and points to still greater changes in the future. How it has worked in the three countries in which it has been in operation for a little more than a century, and what it has done, are the questions which the author undertakes to answer. In England, popular government has taken the form, with a powerless hereditary sovereign commanding universal loyalty, of a ministry responsible to a Parliament, which is directly responsible to the people. In France, the executive is controlled by a legislative body chosen by universal suffrage, the majority of which is held together by party discipline. The virtue of this government is undergoing a supreme test in the Dreyfus case, the right issue of which would show a greater proportional advance in true liberty and the justification of popular government than has taken place in any other nation. In the United States, power is passing more and more into Congress, a body chosen separately from the President, whose members are actuated by personal, local, and partisan motives, and rarely rise to the conception of broad national views or look further than to the immediate present, while the nation at large and the Executive are without representation such as insures the co-operation of the ministry and Parliament in England. In all other respects than appointments to office, which must be made "in strict subordination to the demands of members of his party in both Houses of Congress," the recognized power of the Executive is confined within very narrow limits. In matters of legislation he has no voice whatever beyond general recommendations, such as are open to any citizen, and to which Congress pays little or no attention. In fact, that body resents anything like an expression of opinion from the President. The system is not encouraging to the filling of the office by men of the first rank, and men of that rank seldom reach it. The House of Representatives, meeting every two years a new body, suffers from its entire want of coherency and the absence of a qualified leader, and falls an easy prey to the lobbyist and the boss. So, while "there are still many, perhaps the majority, of men of good character in public life, the tendency is steadily downward." It has been customary in some quarters to charge the evils we suffer upon universal suffrage, but Mr. Bradford maintains that it is this which to-day is keeping up the character of the Government, and that but for the restraints imposed by it our political condition would be a great deal worse than it is. Further light is sought upon the situation, and further pictures are given of the conditions existing in comprehensive reviews of the State and municipal governments of the country. In considering proposed remedies the referendum is dismissed as tending to destroy personality and diffuse responsibility even more than is done now—the reverse of the concentration of executive power as the only really indispensable part of the Government, which should be sought. The enforcement of this principle of executive supremacy with immediate responsibility is the purpose of the book. Mr. Bradford would obtain this by giving the representatives of the administrative departments seats in the House, with power to suggest legislation, make explanations, and participate in debate. His final argument is that it can not be charged that democracy is a failure; but, "with a wholly new force introduced into the world, the proper machinery for its application has not yet been employed. In its nature it is reasonable, sound, and, on the whole, beneficent." Using the words of an English writer, "the failures of government in the United States are not the result of democracy, but of the craftiest combination of schemes to defeat the will of democracy ever devised in the world."

We have already published a fairly comprehensive review of *Richard Semon's In the Australian Bush*,* based upon the German original, by Prof. E. P. Evans, in the fifty-second volume of the Monthly (November, 1897). But little needs to be added to what Professor Evans has said of the book besides announcing the appearance of the English edition, the translation for which was written under the author's own superintendence, and the contents of which do not differ in any important particular from the German impression. Professor Semon went to Australia on a special zoölogical mission, and spent two years there. His purpose was the study of the wonderful Australian fauna, the oviparous mammals, marsupials, and ceratodus (lungfish). These animals represent forms which, with a few notable exceptions, have long since become extinct in other countries, where they have to be studied in such parts of their bony forms as happen to have been preserved in the rocks, while here they can be examined alive and in the flesh—"living fossils," as the author fittingly calls them, links between the present age and one of the geological periods of the past. His observations on these subjects are in course of publication in a special scientific work, not quite half of which has appeared. The present volume consists in the notes of travel and adventure, the dealing with men, the anthropological studies, and what we might call the *obiter* observations of the expedition. Almost simultaneously with Professor Semon's narrative we have from the same publishers another book, on *The Native Tribes of Central Australia*,† which deals more fully, exclusively, and perhaps more expertly with the anthropology of a part of the Australian continent. Of the authors, Mr. *Gillen* has spent the greater part of the past twenty years in the center of the continent, and as sub-protector of the aborigines has had exceptional opportunities of coming in contact with the Arunta tribe; and both of them have been made fully initiated members of that tribe. Though both about Australia, the two books do not cover the same ground. Australia is very large, and its physical conditions are such that the groups of tribes inhabiting the various regions have for a long period of time been isolated from one another and have followed different lines in development. Professor Semon's observations were made in the Burnett district of northeastern Queensland, while those recorded in the work of Spencer and Gillen were made in the very center of South Australia and of the continent. Consequently, in reading them we read really about different things. In addition to the investigation of various customs, such as those

* In the Australian Bush, and on the Coast of the Coral Sea. Being the Experiences and Observations of a Naturalist in Australia, New Guinea, and the Moluccas. New York: The Macmillan Company. Pp. 552. Price, $6.50.

† The Native Tribes of Central Australia. By Baldwin Spencer and F. J. Gillen. New York: The Macmillan Company. Pp. 671, with maps and plates. Price, $6.50.

connected with initiation and magic, special attention has been paid by Messrs. Spencer and Gillen to the totemic system and to matters connected with the social organization of the tribes; and here again the authors insist upon the differences between the groups of tribes, and that the customs of no one tribe or group can be taken as typical of Australia generally in in any other sense than as broad outline. Both works deal with considerable fullness with the institution of marriage among the Australians, and the customs by which too close intermarriage is prevented. Among other subjects treated with especial fullness by Messrs. Spencer and Gillen are the totems, the bull-roarers, the Intichuma ceremonies (associated with the totems), the initiation ceremonies, customs relative to the knockng out of teeth, traditions, burial and mourning, spirit individuals, medicine men and magic, methods of obtaining wives, myths, clothing, weapons, implements, decorative art, and names. Professor Semon formed a moderate opinion of the capacity of the Australians. Though coarse and heavy, their faces are not bad looking and have expression. They are "no link between monkeys and men, but human creatures through and through," though of one of the lowest types. They have no pottery, no agriculture, no abstract ideas of any kind, can not count very far, but are clever in learning to write, read, and draw, are experts in signaling, and have their intellect and senses "brilliantly developed in all directions bearing on the hunt," with great dexterity in the use of weapons.

GENERAL NOTICES.

Miss *Mary H. Kingsley* has given in her *West African Studies* * a book marked by pungent wit and striking originality in its sketches of adventure and observation, and containing in the chapters devoted to ethnology results of her personal studies. She was already known by a record of her adventures of a young Englishwoman traveling alone through some of the worst regions of West Africa, embodied in her book Travels in West Africa, which was published in the latter part of 1898. The present book may be regarded, as its name implies, as the result and the embodiment of the afterthoughts of that hazardous journey. It includes, after descriptions in which the unconventional directness of expression is much to be remarked, an account of African characteristics and a description of fishing in West Africa, chapters of a soberer sort on fetich, schools of fetich, witchcraft, African medicine and the witch doctor, and historical and economical chapters on Early Trade, French Discovery, Commerce, the Crown Colony System and some of its incidents, The Clash of Cultures, and African Property. Miss Kingsley's criticisms of the present system of administration being regarded as rather destructive, she endeavors to set forth, in a chapter entitled An Alternative Plan, "some other way wherein the African colonies could be managed." Special attention is invited by the author to two articles in the appendix to the volume by M. le Comte C. N. de Cardi and Mr. John Harford. We are pleased to note the high appreciation which Miss Kingsley expresses of the anthropological work concerning west-coast tribes of our former contributor, Colonel A. B. Ellis—Sir A. B. Ellis when he died.

Mr. *Frederick Palmer's In the Klondyke* * is an unpretentious book and free from the appearance of sensationalism, but gives a clear and graphic account of the region and its ways and of the getting there at the breaking up of winter. The author was at Dyea late in February, having intended to go with a Government relief expedition which had

* West African Studies. By Mary H. Kingsley. New York: The Macmillan Company. Pp. 633, with Map. Price, $5.

* In the Klondyke, including an Account of a Winter's Journey to Dawson. By Frederick Palmer. New York: Charles Scribner's Sons. Pp. 218, with plates. Price, $1.50.

found no occasion to proceed farther. Being thus left out, he undertook, with dogs and sledges and two companions who proved congenial, the "untried journey" of six hundred miles over the ice fields of the Lewes Lakes and the ice packs of the Yukon River, which had been the contemplated route of the expedition. The start was made about the 18th of March, with little time to spare, because the Yukon was expected to become impassable by the 20th of April. The Chilkoot Pass was achieved in a day, and the rest of the journey was made "downhill with the current of the river at the rate of eight inches to the mile," in weather that became very variable, with now hard freezing and now slush in the middle of the day. The difficulties of the journey must have been formidable, with considerable suffering, besides a week in a hut with the measles, but no complaint further than the mention of the incidents appears in the author's story. On some of the days the thermometer ranged from 10° to 20° below zero at two o'clock in the morning, to 80° above at night, and the author "had one ear blistered by the frost and the other by the sun in the same day." The party arrived at Dawson just four days before the final break-up of the ice in the river. Accounts corresponding in temper and vividness with that of the journey are given of Dawson, the miners and mining, the history of the Klondyke mining enterprise, Klondyke types of character and adventure, the toils and trials and profit and losses of the "Pilgrims," the workings of the Government, and the return home to civilization—which does not appear, after all, to have offered transcendentally superior attractions to those who had experienced the pleasure of adventure.

The *History of Physics in its Elementary Branches* * has been prepared by Professor *Cajori* in the belief that some attention to the history of a science helps to make it attractive, and that the general view of the development of the human intellect gained in reading a history on the subject is in itself stimulating and liberalizing. The author has had in mind Professor Ostwald's characterization of the absence of the historical sense and the want of knowledge of the great researches upon which the edifice of science rests as a defect in the present method of teaching. The subject is treated by periods. In ancient times the Greeks, while displaying wonderful creative genius in metaphysics, literature, and art, being ignorant of the method of experimentation, achieved relatively little in natural science. The Roman scientific writers were contented to collect the researches of Greek professors. Except in a few instances the Arabs did not distinguish themselves in original research. Writers in the middle ages were only commentators, and knew nothing of personal investigation. The physicist of the renascence abandoned scholastic speculation and began to study Nature in the language of experiment. The seventeenth century was a period of great experimental as well as theoretical activity. In the eighteenth century speculation was less effectively restrained and guided by experiments. The nineteenth century "has overthrown the leading theories of the previous one hundred years, and has largely built anew on the older foundations laid during the seventeenth century." The evolution of physical laboratories, first for teachers and then for students, is the subject of the last chapter.

* A History of Physics in its Elementary Branches, including the Evolution of Physical Laboratories. By Florian Cajori. New York: The Macmillan Company. Pp. 322. Price, $1.60.

"The Great Commanders Series" of D. Appleton and Company is enriched by a biography of *General Sherman*,* whom the author, General *Manning F. Force*, styles "the most picturesque figure in our civil war." He was more than this; he was its scholar and statesman—a man distinguished by the possession of high military combined with the best civil qualities. Further, as General Force well says, "his character was absolutely pure and spotless." In his dealings with the Vigilance Committee in San Francisco he assumed a position which it required courage of a much higher order than a soldier's to maintain. While comfortably situated as an honored professor in the State Military Academy of Louisiana when the Legislature passed the Ordinance of Secession, he had no

* General Sherman. By General Manning F. Force. New York: D. Appleton and Company. Pp. 353.

hesitation in deciding what to do. He at once gave in his resignation in a letter that is a model of manliness, declaring his preference " to maintain allegiance to the Constitution of the United States as long as a fragment of it survives." His career as a general in the civil war is described at length. Through it all his foresight, seeking always to accomplish the most with the least expenditure and ultimate suffering, to which his strategy was adapted, is conspicuous. At this time and afterward his supreme thought appears to have been as to what would best conduce to the permanent good of the republic. To his military ability and self-effacing patriotism he added a far-seeing wisdom in council that could always be relied upon. " In his most unguarded words his principle was always clear, noble, and intensely patriotic, and his careless colloquial expressions often covered a practical wisdom and insight of a most striking kind."

In preparing their *Text-Book of Algebra* * the authors, assuming that mental discipline is of the first importance to every student of mathematics, have endeavored to present the elements of the science in a clear and logical form, while yet keeping the needs of beginners constantly in mind. Special attention is given to making clear the reason for every step taken; each principle is first illustrated by particular examples, and then rules and suggestions for performing the operation are laid down. The authors have endeavored to avoid apparent conciseness at the expense of clearness and accuracy, and have thereby made their volume somewhat larger than ordinary text-books. Features to which attention is called are the development of the fundamental operations with algebraic numbers and the concrete illustrations of these operations; the use of type forms in multiplication and division and in factoring; the application of factoring to the solution of equations; the solutions of equations based upon equivalent equations and equivalent systems of equations; the treatment of irrational equations; the discussions of general problems and the interpretation of positive, negative, zero, intermediate, and infinite solutions of problems; the treatment of inequalities and their applications; the outline of a discussion of irrational numbers; a brief introduction to imaginary and complex numbers; and the great number of graded examples and problems.

* Text-Book of Algebra, with Exercises for Secondary Schools and Colleges. By George Egbert Fisher and Isaac J. Schwatt. Part I. Philadelphia: Fisher & Schwatt. Pp. 683. Price, $1.25.

The material of the *Primary Arithmetic*, Number Studies for the Second, Third, and Fourth Grades, of *A. R. Hornbrook* (American Book Company), has been chosen with careful reference to the development of the number sense of little children, as noticed by the author and as reported by many other observers. A distinctive feature of the work is the use of diagrams called " number tables," as a concrete basis for the child's thinking while he is getting his first ideas of the facts of the addition and multiplication tables. In them the numbers up to one hundred are presented in columns of tens, and so handled as to exhibit to the child's conception the relations of the several digits. By their use he first learns the properties of ten, then of two, and so on of the others—not presented in regular order, but with a view of exhibiting special properties—and their relations to one another. The method is ingenious and appears useful.

The study on *Rhode Island and the Formation of the Union*, of the Columbia University Series in History, Economics, and Public Law (The Macmillan Company, New York), was undertaken by Mr. *Frank Greene Bates* in order to ascertain why Rhode Island so long delayed its ratification of the Federal Constitution. The delay seems to have been largely a matter of the assertion of State rights, in which Rhode Island appears at that time to have been but little, if any, behind South Carolina. Liberty " was the presiding genius of the spiritual life of the colony, and the principle of freedom of conscience was never lost sight of; and this could not otherwise than heighten the other characteristics of the colony—individualism." The course pursued was the natural outcome of the conditions of the times, the " outcropping of the undying love of the people of the State for democracy and liberty, and their jealousy of all authority outside their own boundaries."

"No book up to recent date," says the author of *Pantheism, the Light and Hope of Modern Reason*, who signs his name *C. Amryc*, and gives no publisher's name, "has treated pantheism as consistently as it deserves to be treated"; and he adds that "it is no creed; it is a logic; it makes absolutely no demand upon 'belief'; what is not logical is rejected, what is logical to-day is accepted, no matter whether it was unlogical a thousand years ago or will be illogical a thousand years hence; we are only responsible for our times." As pantheism, if it is a true logic, must be applicable to all races, the author has not chosen his examples from one nation or tribe; and he believes that the views he expresses are also those of nine tenths of what is called modern science. Many topics are treated of, some of which would not at first thought be associated with an exposition of pantheism. The matter and manner of the book are various. Parts of it are fairly good reading; other parts strike us as different.

A book on *The Principles of Agriculture*, prepared by Prof. *L. H. Bailey* as a text-book for schools and rural societies, is published as a number of the Rural Science Series of the Macmillan Company ($1.25). In it agriculture is treated as a business, not a science, but as a business which is aided at every point by a knowledge of science. "It is on the science side that the experimenter is able to help the farmer. On the business side the farmer must rely upon himself, for the person who is not a good business man can not be a good farmer, however much he may know of science." The principle of the intelligent application of knowledge is illustrated in a remark of the author's about the treating of drainage. The learner is apt to begin at the wrong end of his problem. In the usual method the pupil or reader is first instructed in methods of laying drains. "But drainage is not the unit. The real unit is texture and moisture of soils—plowing, draining, green cropping, are methods of producing a given or desired result. The real subject-matter for first consideration, therefore, is amelioration of soil, rather than laying of drains." Professor Bailey aims throughout this book to get at "the real subject-matter for first consideration" in matters relating to soils, the plant and crops, and the animals and stock.

Ideals and Programmes (C. W. Bardeen, Syracuse, N. Y., 75 cents) is a collection of thoughtful and suggestive essays, by *Jean L. Gourdy*, on the practical side of school life and the teaching of children. The author's ideal seems to be that the teacher should have a plan for her work, preparing for it so as to have the whole course marked out on general lines for the entire school year. Thus, her occupation should be to qualify herself for doing the work right. These statements of general principles are followed by essays on reading and plans for teaching, correlation as "the headstone of the corner of successful teaching, geography, sand modeling, field lessons, kindergarten training, and discipline." The burden of the whole is by skillful adaptation to get the best possible out of every lesson, in which a liberal use of field work assists greatly, and above all to avoid the stiff, formal, juiceless lessons of the old style of teaching.

There have been several biographies of Faraday, most of them now out of print; but the life, work, methods, character, and aims of the man—who was "beyond all question the greatest scientific expositor of his time"—can not be kept too constantly or too long before the minds of students. Welcome, therefore, is the easily accessible and convenient volume *Michael Faraday: His Life and Work*, which has been prepared by Prof. *Sylvanus P. Thompson*, and is published by the Macmillan Company in their Century Science Series ($1.25). The work by which Faraday contributed so much to the advancement of knowledge is made prominent, and is illustrated largely, due regard being had to the limitations of the size of the book, with citations from his own journal and copies of his drawings.

In *American Indians*, a book second in order but first in date of publication of a series of "Ethno-Geographic Readers" (D. C. Heath & Co., Boston), Prof. *Frederick Starr* has succeeded in conveying a large amount of information about our aborigines in a very small space, and has done it in a clear style and a very satisfactory manner. The book is intended as a reading book for boys and girls in school, to whose tastes and capacity it seems well adapted; but the author will be pleased if it also interests older readers, and hopes it may enlarge their sympathy with our native Americans. Besides the accounts of the tribal divisions, general customs, manner of life, houses, and institutions—which when they are counted up are found to be quite numerous—it has articles on the sign language, medicine men and secret societies, the mounds and their builders, George Catlin and his work, the cliff-dwellings and ruins of the Southwest, the tribes of the Northwest coast, matters of religious and mythological significance, the Aztecs, the Mayas, and the ruined cities of Yucatan and Central America.

The revision, for the fifth edition, of *H. Newell Martin's The Human Body* (Henry Holt & Co., New York, $1.20) was undertaken by Prof. *George Wills Fitz* with the idea of bringing the book into accord with the late developments of physiology, of simplifying the treatment of some parts while expanding that of others, and of giving additional illustrations. Every effort has been made to avoid injuring those features of the author's work which have contributed to making the book so favorably known. The changes in the first nine chapters are largely verbal; but considerable alterations and additions have been made in some of the succeeding chapters. The directions for demonstrations and experiments have been greatly enlarged and collected into an appendix. They include the new requirements in anatomy, physiology, and hygiene for admission to Harvard College and the Lawrence Scientific School.

We have already noticed some of *Lucy S. W. Wilson's* excellent Manuals on Nature Study, particularly the one intended for the guidance of teachers. We now have in the same line the *First Reader* of a series on *Nature Study in Elementary Schools* (New York: The Macmillan Company, 35 cents), a book composed of original matter and selections which has been prepared "with the desire of putting into the hands of little children literature which shall have for their minds the same interest and value that really good books have for grown-up people." But the author does not expect to accomplish this by merely giving the book to the child and leaving the reading to work out its own effect. Each of the lessons is intended to be preceded by a Nature lesson. During or after the reading a lesson should be given in the new words introduced, and afterward the lessons should be grasped for the sake of thought. The lessons, which have appropriate illustrations from Nature, present some novel features. Among them is an apparent intention in the original compositions to follow the child's method of thought.

The American Elementary Arithmetic (American Book Company) is intended by the author, Prof. *M. A. Bailey*, to cover the first five years' work (beginning apparently very young) in the study, and is the first of a two-book series. It is divided into two parts—for the primary and for the three succeeding grades. It contemplates the use of apparatus, consisting of paper, pasteboard, toy money, blocks, and splints. The attempt is made to give every subject twice: first in pictures, and second in the particular form of printed words. Mathematical conceptions are presented in the first chapter in the order in which they are supposed to arise in the child's consciousness—first, once or more, indefinitely; next, how many, by holding up fingers, laying down sticks, etc.; and then by words, and so on—all introductory work designed to develop step by step a mathematical vocabulary, and to form a habit of clear mathematical thinking. The laboratory plan is followed in the succeeding chapters.

In the *Language Lessons* of *J. G. Park* (American Book Company) an arrangement of the matter is aimed at which will draw upon the student for such effort as may be expected at a given stage of advancement, which will cause him to think first and then to express his thought with clearness and precision. In the succeeding parts are given exercises on language work, with special drills upon capitalization and punctuation, inductive lessons in grammar, and, finally, lessons so graded that a student may advance very readily from them into the higher work of grammar. The study is facilitated by the use of striking illustrations as the basis of lessons.

The *Semi-annual Report of Schimmel and Company* (Leipsic and New York), though primarily a business document, furnishes much information about the industries in essential oils and fine chemicals, and concerning progress in the departments of chemical science relating to these. The report for October, 1898, speaks of much research and many valuable studies as having been carried on during the preceding six months in the domain of the essential oils and their constitution, and of ample material for scientific reports as having been gathered.

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Fragments of Science.

The Gypsies and their Folk Tales.—In the introduction to his collection of Gypsy Folk Tales Mr. Francis H. Groome describes the wide dispersion of the gypsy race as extending, in Europe, from Finland to Sicily, and from the shores of the Bosporus to the Atlantic seaboard; in Asia, from Siberia to India, and from Asia Minor (possibly) to China; in Africa, from Egypt and Algeria to Darfûr and Kordofan; and in America, from Pictou in Canada to Rio Janeiro. Believing that the gypsies, originating in India, left that region at an unknown date very long ago, he traces their migrations in the past and shows that a part of the race is still very migratory, passing, among other routes, between Scotland and North America, and between Spain and Louisiana. Another migration not mentioned in his book is the annual oscillation between north and south of the North American gypsy colony, which is growing healthily. The author finds it at present quite impossible to fix the arrival of the gypsies in southeastern Europe at a thousand years before Christ or a thousand years after. If the Komodromoi of the Byzantine writers were gypsies, then these people must have been a recognized and familiar element of the Balkan population about as early as the latter date. Gypsies pass for a very cunning people, and such they are to outsiders, so that Romany or gypsy guile is a very common expression. Centuries of suspicion and repression have taught them to arm themselves proof against confidence in strangers; but to those who become acquainted with them, as Mr. Groome professes to have done and George Borrow did, they present a character of simplicity and frankness. There is, as a gypsy woman once said to a writer in The Athenæum, "somethin' in the mind of a Gorgio that shuts the Romany's mouth and opens his eyes and ears." Gypsies are active transmitters of folklore, and have rich funds of stories; and many believe that the folklore stories of Europe are traceable to Indian sources, whence they may have been transmitted to Europe. Mr. Groome suggests how some of these stories may have originated by telling of a gypsy girl he knew who dashed off "what was almost a folk tale impromptu." She had been to a picnic in a four-in-hand with "a lot of real tiptop gentry," and "Reia," she said to me afterward, "I'll tell you the comicallest thing as ever was. We'd pulled up to put the brake on, and there was a *puro hotchiwitchi* (old hedgehog) come and looked at us through the hedge, looked at me hard. I could see he'd his eye upon me. And home he'd go, that old hedgehog, to his wife, and 'Missus,' he'd say, 'what d'ye think? I seen a little gypsy gal just now in a coach and four horses,' and 'Dabla,' she'd say, 'bless us, every one now keeps a carriage.'"

Educational Work of an Experiment Station.—The survey of the year's work of Cornell University Agricultural Experiment Station in its efforts to "help the farmer" by dealing with present-day problems includes mention of its investigations, related in bulletins published or to be published in reference to fruits, their insect and fungoid enemies, vegetables, flowers, sugar beets, potatoes, fertilizers, beans, the dairy, veterinary science, horticulture, and plant disease. Much of the work of the station can not be published, consisting as it does of correspondence, personal advice, attending meetings, making records, or the performance of special illustrative experiments at farmers' homes or in neighborhoods as object lessons. "It is a pity," the report says, "that every farmer in the State can not be personally touched at least once in his life by the methods and the inspiration of a good teacher." The itinerant schools which were held in the early days of the extension work are regarded as being most beneficial when the community has been awakened by simpler and more elementary means, while the larger part of the work can be done more economically than by them. Yet in particular places and cases they are of greatest value, and they are still held when suitable conditions prevail. Special dairy schools, largely of the nature of practical demonstrations, were held at various places. The report lays much stress on the importance of beginning the educational work with the children and upon the value of Nature study. More than sixteen thousand school children have requested and been supplied with information on the making of gardens.

Flies as Bearers of Disease.—In estimating the relative importance of flies and water supply in spreading disease, Dr. M. A. Veeder distinguishes between intestinal and malarial disorders. In the former the infection is a bacillus of some sort, the presence of which can be traced to contamination by excretions from a diseased bowel. In the latter the source of infection is peculiar to marshy or stagnant water, and independent of contamination from human sources. It is the author's belief that, with relatively unimportant exceptions, intestinal diseases are spread almost exclusively by flies and malarial diseases by water, and he supports it by citations from recent army experiences. Likewise, during the recent British campaign in Fashoda, which was most carefully planned and took place in a climate that is exceptionally dry and hygienic, there was no abatement of typhoid fever. In the case of an outbreak of malignant dysentery described by the author in a previous paper, taken at its height, not a new case occurred after measures were adopted that made conveyance by flies impossible, although there had been fresh ones every day for some time previously. Another more recent "lively epidemic" of typhoid mentioned by the author was ended in a day by measures directed against conveyance by water. "When flies are responsible, there are little neighborhood epidemics, extending in short leaps from house to house, without reference to water supply or anything else in common. But when water is at fault the disease follows its use wherever it may go. . . . Epidemics spread by flies tend to follow the direction of prevailing warm winds, as though the fly, wandering outdoors after contact with the source of infection, had drifted with the wind, but nothing of the sort is perceptible in the case of water-borne disease."

Pottery Making and Lead Poisoning.—The report of Professors Thorpe and Oliver on the subject of the employment of compounds of lead in the manufacture of pottery, especially in its relation to the health of the work people, has just been issued as an English blue book. It appears that of the total male workers in the year 1898, 4.9 per cent became "leaded," while of the female workers the proportion was 12.4 per cent. It is stated that in the last six months many successful attempts have been made by the manufacturers to substitute a leadless glaze, and there seems no doubt that glazes of sufficient brilliancy, covering power, and durability are now within the reach of the manufacturer. The exclusion of women from certain parts of the work, except where leadless glazes are used, is advocated, and also various expedients for preventing the absorption of the lead by the skin, such as rubber gloves or "dipping" tongs. Their general conclusions are as follows: "That by far the greater amount of earthenware of the class already specified can be glazed without the use of lead in any form. It has been demonstrated, without the slightest doubt, that the ware so made is in no respects inferior to that coated with lead glaze. There seems no reason, therefore, why in the manufacture of this class of goods the operatives should still continue to be exposed to the evils which the use of lead glaze entails. There are, however, certain branches of the pottery industry in which it would be more difficult to dispense with the use of lead compounds. But there is no reason why, in these cases, the lead so employed should not be in the form of a fritted double silicate. Such a compound, if properly made, is but slightly attacked by even strong hydrochloric, acetic, or lactic acid. There can be little doubt that, if lead must be used, the employment of such a compound silicate—if its use could be insured—would greatly diminish the evil of lead poisoning. The use of raw lead as an ingredient of glazing material, or as an ingredient of colors which have to be subsequently fired, should be absolutely prohibited. As it would be very difficult to insure that an innocuous lead glaze shall be employed, we are of opinion that young persons and women should be excluded from employment as dippers, dippers' assistants, ware cleaners after dippers, and glost placers in factories where lead glaze is used, and that the adult male dippers, dippers' assistants, ware cleaners, and glost placers should be subjected to systematic medical inspection. In the 1893 report the medical members of the committee expressed the opinion that 'many old factories are wholly, or in part, unfit in a sanitary point of view for occupation,' and they suggested that 'there should be some authority to close them, or whatever part of them is condemned, on the same principle as dwellings are declared uninhabitable.' We share this opinion and we concur in the suggestion. Certain of the factories we have inspected are in the last stages of dilapidation, and it appears to us to be well-nigh impossible to introduce into them such rearrangements or additions as are required by the amended special rules."

The Longevity of Animals.—The following interesting table, showing the periods of maturity and the full term of life of various animals, was prepared by

E. D. Bell and appeared in Nature for March 23d. The table was made for the purpose of demonstrating a constant relation (in length) between these two periods of life, which the author expresses in the following formula, in which f. t. l. = full term of life, and p. m. the time required to arrive at maturity:

$$\text{f. t. l.} = \frac{10.5\ (\text{p. m.})}{\sqrt[3]{(\text{p. m.})}},\ \text{or}\ 10.5 \times (\text{p. m.})^{\frac{2}{3}}$$

and which seems to be fairly well borne out by the table:

ANIMAL.	OBSERVATIONS.			f. t. l. by formula.
	Authority.	p. m.	f. t. l.	
		Mos. Yr.	Yrs.	Years.
Dormonse.	Ainslie Hollis	3 .25	4–5	4.167
Guinea-pig	Flourens.	7 .583	6–7	7.33
Loprabbit:				
Buck ...	R. O. Edwards, p. m.	9 .75	8	8.67
Doe	R. O. Edwards, p. m.	8 .667	8	8.013
		Years.		
Cat	St. G. Mivart.	1	12	10.5
Cat	J. Jennings.	2	15	16.67
Goat	Pegler.	1.25	12	12.18
Fox	St. G. Mivart.	1.5	18–14	13.76
Cattle	Ainslie Hollis	2	18	16.67
Large dogs	Dalziel, p. m.	2	15–20	16.67
Eng. thoroughbred horse....	Ainslie Hollis	4.5	30	28.62
Hog	James Long.	5	30	30.7
Hippopotamus	Chambers's Encyclopædia.	5	30	30.7
Lion	St. G. Mivart.	6	30–40	34.67
Eng. horse —hunter.	Blaine.	6.25	35	35.63
Arab horse	Ainslie Hollis	8	40	42.00
Camel	Flourens.	8	40	42.00
Man	Buffon, f. t. l.	25	90–100	89.77
Elephant..	Darwin.	30	100	101.4
Elephant..	C. F. Holder and Indian hunters.	35	120	112.35

The Manufacture of Firecrackers in China.—There were exported from China during the year ending June 30, 1897, 26,705,733 pounds of firecrackers, all from the province of Kwantung. The exports, however, represent only a small portion of the number manufactured, as the use of the cracker is universal all over China. They are used at weddings, births, funerals, at festivals, religious and civil, and in fact on all occasions out of the ordinary routine. The United States consul general at Shanghai gives the following account of the industry: There are no large factories; the crackers are made in small houses and in the shops where they are sold. In making them only the cheapest kind of straw paper is used for the body of the cracker. A little finer paper is used for the wrapper. A piece of straw paper, nine by thirty inches, will make twenty-one crackers an inch and a half long and a quarter inch in diameter. The powder is also of the cheapest grade, and is made in the locality where used. It costs about six cents per pound. For the fuse a paper (called "leather" in Shanghai) is used, which is imported from Japan, and is made from the inner lining of the bamboo. In other places a fine rice paper is used, generally stiffened slightly with buckwheat-flour paste, which the Chinese say adds to its inflammability. A strip of this paper one third of an inch wide by fourteen inches (a Chinese foot) long is laid on a table, and a very little powder put down the middle of it with a hollow bamboo stick. A quick twist of the paper makes the fuse ready for use. The straw paper is first rolled by hand around an iron rod, which varies in size according to the size of cracker to be made. To complete the rolling a rude machine is used. This consists of two uprights supporting an axis from which is suspended, by two arms, a heavy piece of wood, slightly convex on the lower side. There is just room between this swinging block and top of the table to place the cracker. As each layer of paper is put on by hand, the cracker is placed on the table and the suspended weight is drawn over the roll, thus tightening it until no more can be passed under the weight. For the smallest "whip" crackers, the workman uses for compression, instead of this machine, a heavy piece of wood fitted with a handle like that of a carpenter's plane. In filling crackers, two hundred to three hundred are tightly tied together in a bunch; red clay is spread over the end of the bunch, and forced into the end of each cracker with a punch. While the clay is being treated a little water is sprayed on it, which makes it pack closer. The powder is poured in at the other end of the cracker. With the aid of an awl the edge of the paper is turned in at the upper end of the cracker, and the fuse is inserted through this. The long ends of the fuses are braided together in such a way that the crackers lie in two parallel rows.

The braid is doubled on itself, and a large, quick-firing fuse inserted, and the whole is bound with a fine thread. The bundle is wrapped in paper and in this shape is sent to the seacoast. A variety of cracker which is very popular in China is the "twice-sounding" cracker; it has two chambers, separated by a plug of clay, through which runs a connecting fuse. There is also a fuse extending from the powder in the lower chamber through the side of the cracker. When the cracker is to be fired, it is set on end and fire applied to the fuse. The powder exploding in the chamber throws the cracker high in the air, where the second charge is exploded by fire from the fuse extending through the plug between the two chambers. In the manufacture of these the clay is first packed in with a punch to form the separating plug. The lower chamber is then loaded with powder and closed by turning over the paper at the end. The upper chamber is loaded and closed with clay. A hole is punched in the side of the lower chamber with an awl, and the fuse inserted through this opening.

An Enchanted Ravine.—During his archæological researches in the Uloa Valley, Honduras (Memoirs of Peabody Museum), Mr. George Byron Gordon made an excursion to the wonderful enchanted ravine, *Quebrada Encantada*, which was famous through all the country for its weather wisdom. It was situated in a deep valley, and, Mr. Gordon says, "sends forth a loud melodious sound which may be heard many miles away, and is regarded by the people of the region as an infallible sign of rain. In fact, it is a regular weather bureau, with this peculiarity, that it is always reliable; for the sound is so modulated as to indicate by its pitch whether the coming storm is to be heavy or light. The amount of promised rain is in exact proportion to the volume of the sound, and thus it proclaims to the accustomed ear with unerring precision the approach of a passing shower or heralds the terrific thunderstorm of the tropics; and this is no fiction, but a fact, which any one may demonstrate for himself by going and listening to it." Tradition says the ravine was the abode of a golden dragon, and that in former times "it was lined with golden pebbles and the sands at its margin were grains of gold, and it was the custom of the golden dragon to rise occasionally to the margin of the pool and receive the offerings that were made to him by the people. If they wanted rain, they would bring their offerings and lay them on the golden sand behind the pool or cast them on the water; then, while all the people chanted a prayer, the dragon would rise from the cave where he dwelt in the depths of the pool, and take the good things that were offered him, and there was never a drought or a famine in the land. Then, when the Spaniards came and the people were driven from their homes, the golden pebbles and grains of gold disappeared, and the golden dragon, retiring into the uttermost corner of his watery cavern, withdrew forever from the upper world. There he still lives, and, as formerly, controls the clouds and the winds that bring the rain. The spirits of the Indians, too, still hold their meetings of an occasional evening by their accustomed pool, now lost in the solitude of the forest, and it is the sound of their chanting that makes the voice of the ravine." The pool is formed by a cataract tumbling down the side of the mountain and making a final fall of fifty feet, and the sound of the tumbling of the waters forms the basis of the pretty legend.

The Work of the Field Columbian Museum.—Making only a selection from the numerous items of general interest in the Annual Report of the Director of the Field Columbian Museum, Chicago, for 1897–'98, we find mentioned the fall and spring courses of nine lectures each, as having been more largely attended than ever before, hundreds of persons having been turned away from some of them, and in one case nearly a thousand. The library contains 9,003 books and 9,630 pamphlets, and has had some valuable additions, particularly in the department of Americana. The additions to the collections include specimens from Egypt, Italy (ancient Etruscan and renaissance Venetian), Portuguese South Africa, Pacific islands, and Alaska, the department representing which now numbers more than ten thousand objects. Valuable contributions have been received from the expedition of the curator of the anthropological (physical) department to Arizona. The herbarium of the late Mr. M. S. Bebb, added to the botanical department, represents much of the flora of the Western States, and "about all" that of Illinois. Numerous other botanical collections and additions to the geological and zoölogical departments are mentioned. Field work was prosecuted by Mr. G. A. Dorsey among the Hopi Indians in Arizona, C. F. Millspaugh in the collection of North American forest trees, and O. C. Farrington in the Tertiary geology of South Dakota, Nebraska, and Wyoming. Other excursions were made among the zinc-lead deposits of southeast Missouri, to the Olympian Mountins of the Northwest, to "a point beyond which nothing unless provided with wings could go," etc., all resulting in collections of one kind or another. The museum was visited by 3,963 more persons than in the year before.

A Year at Harvard Observatory.—The director of Harvard College Observatory reports the addition to the resources of the institution of twenty thousand dollars bequeathed by Charlotte Maria Haven, and twenty-five thousand dollars by Eliza Appleton Haven, without further restriction in the application of the income than that it shall be for direct purposes connected with astronomical science. In these bequests the legators fulfilled the wishes of their brother, Horace Appleton Haven, as expressed half a century ago. By the peculiar organization of the force of the observatory, with a single director to oversee all and a large force of assistants, each having a special work and many of them skillful only in that, an increased amount of work can be done for a given expenditure, and great advantages for co-operation are secured, but too much depends upon a single person—the director. In the examination of the spectra of stars photographed in the Draper, Bruce, and Bache telescopes by Mrs. Fleming, twelve new variable stars were discovered by means of their bright hydrogen lines, and the spectra of a considerable number of other stars were determined. Valuable results, obtained by other examiners, are mentioned. An instrument has been constructed by which prismatic spectra can be converted into normal spectra or any other desired change of scale can be effected. By photographs obtained of stars in the vicinity of the north pole material is believed to be furnished for an accurate determination of the constants of aberration, nutation, and precession. Sixteen circulars were issued during 1897–'98. When fifty of these circulars have been issued, a title-page and index are to be published for binding.

Putting Life in the School.—The discussion of the hygiene of instruction, said Dr. G. W. Fitz, in addresses which are published in the American Physical Education Review, brings us at once face to face with one of the gravest problems of our educational system—the depressing effect of school routine. In the search for a remedy "the school programme has been pronounced poor, and efforts have been made to enrich it. The work has been pronounced abstract and object lessons have been introduced; uninteresting and bright colors, varied shapes, pictures innumerable, have been rushed upon the child until he has been bewildered by the multiplicity of detail, and further exhausted by the demand for more discriminating attention. The fundamental difficulty has been that too much has been required of the child in the beginning, and the attempt at enrichment and greater variety has but increased the burden." Children begin learning to read before they have acquired experience and ideas to match the text; and "experience has shown over and over again that the child who begins to read at eight or even ten years of age is in no wise handicapped in his later intellectual progress. He has the inestimable advantage of intense interest, roused by his growing ability to unlock the secrets of books and papers after the fashion of his elders." Writing is taught before the child has acquired the art of fine co-ordination, and the effort demanded in the use of the pen "leads to a degree of nervous exhaustion unapproached by any other school work." In arithmetic the children "are unable to grasp the numerical relations involved, and the drill, which makes it a pure exercise of memory, is necessary. Much of the aversion to arithmetical problems found later is undoubtedly due to this disheartening primary work. Here again the child who begins arithmetic at eight or ten years of age finds himself able to take it up quickly and has the liking for it that easy mastery always gives." Nature work, on the other hand, "offers wonderfully interesting and valuable material for awakening the intellectual activities of childhood, and while its material for study and description is unlimited, its demand upon the child may be perfectly adapted to his power of observation. We must remember that physical activity is the supreme factor in the development of the child." This means spontaneous play under favorable conditions, not "that nervously exhausting and deadening drill known as the Swedish gymnastics, which . . . adds fatigue to fatigue, by taking the initiative away from the child and forcing him to pay constant attention to the orders of the teacher." As to discipline, "the child is self-disciplined when he is held to his work by the reflex attention of interest. This can always be secured when the work is adapted to his grasp, when he has the sense of power which comes with easy conquest, when he is not exhausted by the imposition of a sequence logical to the adult mind but meaningless to him, when his attention is not dulled by a demand for attention continued beyond a physiological limit."

Beautifying the Home Grounds.—The Horticultural Division of the Cornell University Agricultural Experiment Station has been making efforts during the past few years, under the auspices of the agricultural extension work, to improve the surroundings of rural houses, a part of which consists in the publication of bulletins giving hints as to how improved conditions and simple adornments may be obtained without great expense. One of these indicates as one of the means of making the home attractive and "keeping the boy on the farm" the brightening of the place with flowers. Assuming that the main planting of any place should be of trees and shrubs, the flowers are then used as decorations. They may be thrown in freely about the borders of the place, but not in beds in the center of the lawn. They show off better when seen against a background, which may be foliage, a building, a rock, or a fence. "Where to plant flowers is really more important than what to plant. In front of bushes, in the corner by the steps, against the foundation of the residence or outhouse, along a fence or walk—these are places for flowers. A single petunia plant against a background of foliage is worth a dozen similar plants in the center of the lawn. . . . The open-centered yard may be a picture; the promiscuously planted yard may be a nursery or a forest. A little color scattered in here and there puts a finish to the picture. A dash of color gives spirit and character to the brook or pond, to the ledge of rocks, to the old stump, or to the pile of rubbish." The flower garden, if there is one, should be at one side of the residence or at the rear, "for it is not allowable to spoil a good lawn even with flowers."

MINOR PARAGRAPHS.

Of the twelve genera and fifty species of known North American frogs and toads, Mr. William L. Sherwood says, in his paper in the Proceedings of the Linnæan Society, New York, that five genera and fifty species are found in the vicinity of New York city. Some of these are less secretive in habit than salamanders, and therefore much better known. As ponds and ditches have been drained, the aquatic forms have removed to greater distances from human dwellings, and only the more terrestrial toad and arboreal tree frogs have remained. All of our species have been described, but the author believes that the first mention of the cricket frog being found in this region is in a paper on salamanders, read by him in 1895. The breeding habits of these animals vary, but all lay their eggs in water or moist places. The purely amphibious and really aquatic species are three. Of the other eight species, one is burrowing, five tend to be terrestrial, inhabiting the woods and fields, and two are arboreal. The eggs are laid in gelatinous envelopes, which swell after leaving the adult. At the time of hatching the young tadpole has three pairs of external gills, but no mouth or anal opening. Two small suckers, just back of where the mouth is to appear, enable it to cling to aquatic plants and prevent its dropping to the bottom of the pond and getting smothered in the mud. It soon develops into a tadpole, and proceeds to its development; but if prevented from coming to the surface of the water no metamorphosis takes place, and the changes are delayed by cold and dark.

At a meeting recently held in Berlin in behalf of a German antarctic exploration, Dr. von Drygalski, speaking of the scientific, practical, and national importance of the enterprise, said that from a geographical point of view the fundamental problem attached to the south polar region—the verification or disproof of a polar continent—is still unsolved. No less important questions likewise await solution with respect to the geological structure and character of the southern lands—so important in connection with a knowledge of volcanic action and the supposed former connection of South America and Australia—and with respect to the conditions of inland ice. Even the study of the floating ice broken away from the main mass may lead to important conclusions as to its mode of origin and the nature of the land from which it comes. Other problems to be investigated are the origin of the cold ocean currents that take their rise in the south, the conditions of the atmospheric pressure and temperature in that region, and the questions relating to terrestrial magnetism, which have a very important bearing on the practice of navigation. The present seems to be a particularly favorable period for the resumption of south polar research by reason of the unusual amount of drift ice which has within the last few years broken away from the main mass, and because, according to Supan, we are passing through a warmer temperature period.

Over and above the statistics and the bare record of facts the annual reports of the Perkins Institution and Massachusetts School for the Blind afford a continuous and growing interest to friends of suffering mankind in their stories of the development of mental life and illumination. Pupils come there blind and deaf, and apparently without any avenues of intelligent communication with the outer world, and are there brought to full consciousness and keenness of intellect that would be remarked even in many persons possessed of all their senses perfect from birth. The record began with Laura Bridgman, was continued with Helen Keller, and has been occupied for five or six years past with the wonderful mental growth of Elizabeth Robin, Edith M. Thomas, and Tommy Stringer. Before Dr. Howe began with Laura Bridgman, such things would have been deemed impossible and not to be thought of.

NOTES.

The Swiss Association for the Protection of Plants, which was formed in Geneva in 1883, has more than 900 members, and publishes 1,500 copies of its bulletin, which is sent, besides the members of the association, to the libraries of foreign Alpine clubs, the press, botanists, *curés*, and municipalities in countries harboring plants that require protection. Under its care, or the influence of its work, gardens have been created in various places and devoted especially to the cultivation of such plants as are most threatened with extinction. Of these are the Linnea Garden in the Valais, 5,500 feet above the sea; the Chanousia, founded five years ago by R. P. Chanoux, rector of the Hospice of St. Bernard, 6,800 feet; and the Rambertia, at the foot of the Rochers de Naye, 6,500 feet above the Lake of Geneva. Lectures are given under the auspices of the association, and no occasion for informing the public is lost. A neat chromo-poster calling attention to the association and its purpose has been prepared to be put up in railroad stations and hotels, to which is appended a motto emphasizing the importance of caring for rare plants.

The report of Heinrich Ries on the Kaolins and Fire Clays of Europe, published in the reports of the Geological Survey, is based largely on notes collected by the author during visits in 1897 to most of the important kaolin and clay deposits. To these such facts of importance concerning the clays as have already been published have been added. Some manufacturers have claimed that the foreign kaolins are superior to the American, but the evidence, Mr. Ries says, does not seem to bear out the statements. Notes are added respecting the clays and clay-working industries in the States of Alabama, Arkansas, Indiana, Iowa, New York, and North Carolina.

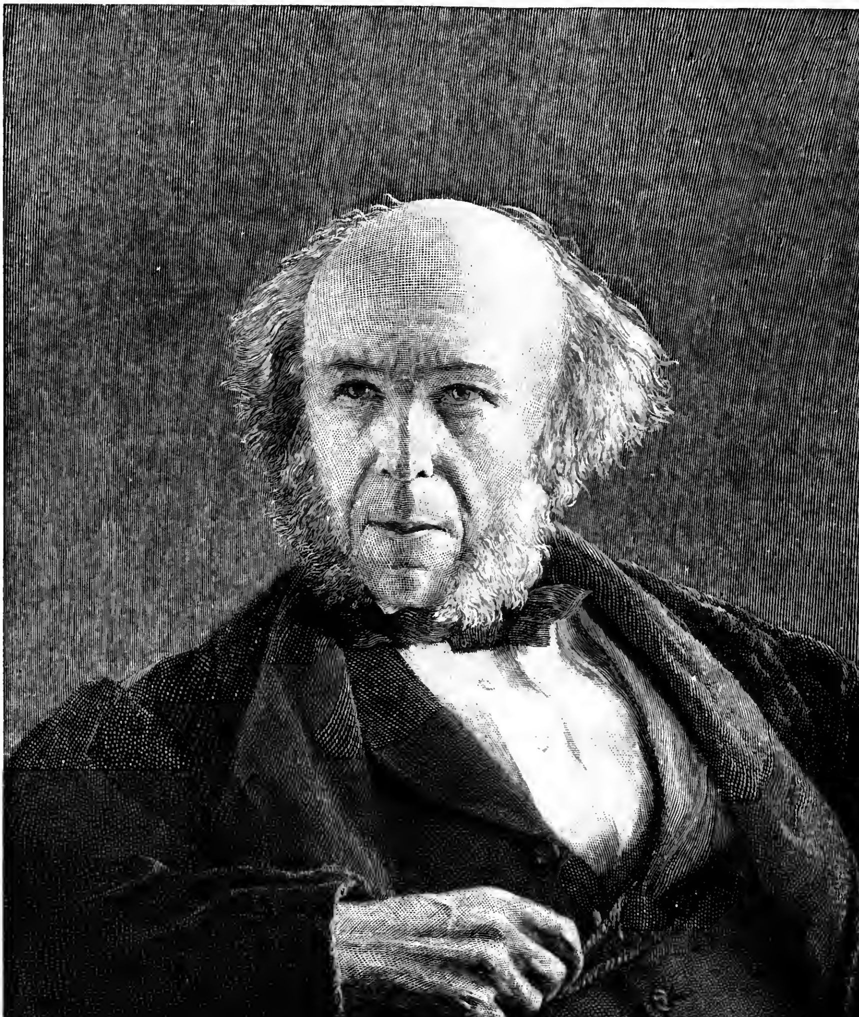
According to the report of the *Commission Internationale des Glaciers* for 1897, thirty-nine out of fifty-six glaciers observed in Switzerland are retreating, five are at a standstill, and twelve are growing. Of the Italian glaciers, those of the Disgrazia and Bernina groups and the glaciers of Mont Canin in the Julian Alps show a marked retreat. Retreat seems to be almost universal in the Scandinavian glaciers. The report includes also information from the Caucasus, Altai, and Turkestan, and notes on a few glaciers in the United States and Mexico, concerning which we have not the particulars.

In a book on social types among the French people, M. Edmond Demolins tries to show that varieties of types are the products of constant causes which it is possible to analyze exactly, and the most fundamental principle of which is the nature of the place and of the occupation. Thus there is a social type derived from the pastoral occupation; another from the cultivation of fruit trees, among which the several classes determine as many modalities of the type; one is derived from petty gardening, and another from large farming; another from manufacturing, and another from transportation and commerce. Close analysis permits the detection of still more delicate shades of types of varieties in each of the categories named, whereby notable modifications are produced in the same region and the same work.

The brewing industry in Germany is credited with the following output of beer for the year 1897–'98: Germany proper, 8,055 breweries, exclusive of Bavaria, Würtemberg. Baden, and Alsace-Lorraine, 916,000,000 gallons; Bavaria, 6,364 breweries, 351,000,000 gallons; Würtemberg, 6,285 breweries, 90,000,000 gallons; Baden, 946 breweries, 60,000,000 gallons; Alsace-Lorraine, 127 breweries, 21,230,000 gallons—a grand total of 1,438,230,000 gallons, from the taxation of which the Government received a revenue of $22,305,150.

Speaking in his society of the Relation of Britain to Folklore, retiring President Alfred Nutt urged that it was the privilege of that country to enshrine in its literature the ancient customary wisdom of many races, as the English system of law was itself largely derived from custom. The accidents of the geographical position and historical circumstances of Britain had made it the preserver of a great body of archaic tradition, which it was the function of the Folklore Society to study and interpret.

We have to record the deaths of Dr. William Hankel, Professor of Physics in the University of Leipsic; Prof. F. K. C. L. Büchner, author of the famous book, Force and Matter, at Darmstadt, Germany, May 1st; Dr. Francis W. MacNamara, State Examiner of Medical Stores at the India Office, London, formerly Professor of Chemistry in Calcutta Medical College, and later Chemical Examiner to the Government of India, March 5th, aged sixty-seven years; he was author of a number of books and papers on hygiene and medical chemistry; Jeremiah Head, engineer, President of the Mechanical Science Section of the British Association in 1893, and President of the British Institute of Mechanical Engineers in 1885–'86, March 10th, aged sixty-four years; who was instrumental in introducing into England important American improvements in the manufacture of iron and steel; Franz Ritter von Hanse, Austrian geologist, Intendant of the National Museum in Vienna, Director of the Imperial Geological Survey in 1866, and author of the Geological Map of Austria, Bosnia, and Montenegro, and of geological books, March 20th, aged seventy-seven years; Surveyor Major G. C. Wallich, March 31st, in his eighty-fourth year, and Count Abbé F. Castracan, of Rome, the two oldest Fellows of the Royal Microscopical Society; Dr. P. L. Ryke, of the University of Leyden, aged eighty-six years; Joseph Stevens, honorary curator of the museum at Reading, England, author of archæological and geological papers; Dr. C. Brogniart, entomologist, and author of a memoir On Fossil Insects of the Primary Period, at Paris; Charles L. Prince, author of papers on meteorology and astronomy, at Tunbridge Wells, England, April 22d; Dr. Wilhelm Jordan, Professor of Geometry and Geodesy at the Technical Institution, Hanover, April 17th, aged fifty-seven years; Sir William Roberts, of the Royal College of Physicians, author of lectures and papers on digestion, diet, uric acid, the opium habit in India, etc.; Prof. Karl Scheibler, chemist, at Berlin, aged seventy-two years; Dr. Josef Wastler, docent in geodesy at the Technical Institute in Graz; Dr. H. A. Wahlforso, Professor of Chemistry at Helsingfors, aged sixty years; and Philip Thomas Main, Fellow of St. John's College, Cambridge, England, author of a treatise on astronomy.



Herbert Spencer

APPLETONS' POPULAR SCIENCE MONTHLY.

AUGUST, 1899.

PUBLIC CHARITY AND PRIVATE VIGILANCE.

By FRANKLIN H. GIDDINGS, Ph. D.,
PROFESSOR OF SOCIOLOGY IN COLUMBIA UNIVERSITY.

THE Comptroller of the City of New York deserves the thanks of all good citizens for his serious indictment of the abuses of public charity that have grown up in this city and State within the past ten years. Probably very few of the more intelligent men and women of the community were aware that three million dollars, raised by taxation, are annually appropriated to the assistance of private charitable institutions, over which the public has no real control and only the most shadowy authority through the inspection of the State Board of Charities. Of those who were informed of this fact, very few indeed were acquainted with the specific abuses which the comptroller's article exposes. To a few individuals, however, who have devoted time and money unselfishly to the defense of public interests and to the exposure of the evils of irresponsible relief, these facts have long been familiar. Such can not fail to take satisfaction in the clear presentation of the case by Mr. Coler. Especially to the men and women who have been connected with the work of the State Charities Aid Association and the Charity Organization Society will Mr. Coler's article be welcome, as a strong reenforcement of arguments which they for years have been presenting to the people of New York, oftentimes, it has seemed, to but unwilling hearers.

It is therefore in no spirit of fundamental disagreement, but rather in the desire to further the reform which the comptroller demands, that I venture to criticise in two particulars the statement as he has left it.

It is an incomplete view of the enormously difficult problem of charity which fails to set forth some of the reasons that have led to the growth of an excessive faith in the excellence of private institutions and in the wisdom of a co-operation between them and the public, which is taken for granted when they receive appropriations of public money.

Great as have been the abuses associated with private charity, they are small when compared with the abuses that have existed in the public administration of poor relief. As all familiar with the history of this subject know, the old English poor law was so administered in the rural parishes that paupers were in a more eligible position than industrious farm laborers; that women with bastard children were publicly rewarded for unchastity; and that, now and again, rent-paying farmers were willing to surrender their lands to the paupers to work them for what could be made, rather than to go on paying rates. The exposure of the evils of the system, which was made in the report of the famous Poor Law Commission appointed in 1832, and the attempt to abolish them by the provisions of the Poor Law Amendment Act of 1834, ought to be studied by every citizen who desires to perform his full duty as a guardian of public interests, and especially by every individual whose sympathies lead him to undertake any practical effort for the amelioration of pauperism. In the United States, on account of the extremely decentralized character of our poor-relief system generally, we have no such impressive body of critical literature as that which was brought out in England during the first half of the present century. None the less, whenever special investigations of the management of town and city relief administration and of the management of almshouses have been made, deplorable abuses have almost invariably been exposed, and individuals acquainted with the facts have argued that any possible misdirection of either private or public funds through private agencies could not equal the corruption and the inhumanity for which officialism has been responsible.

Let us look at one noteworthy example. In 1891 a special committee appointed to report on outdoor alms in the town of Hartford, Connecticut, discovered a state of affairs with which nothing revealed in Mr. Coler's statements can for a moment be compared. The general situation, the committee said, was found to be as follows:

"In 1885 Hartford was paying $2.07 for each man, woman, and child of its population in poor relief. New Haven was paying $1.30; Bridgeport, $1.03; Waterbury, 81 cents; Norwich, $1.54; New Britain, $1.39, etc.; for twelve Connecticut cities an average of $1.22 per capita against our $2.07; and with Hartford far ahead of her nearest competitor. For outdoor relief the figures were similar. Hartford, 90 cents per capita; New Haven, 51 cents; Norwalk, 23 cents, etc.—an average for the twelve of 61 cents per capita, with only one higher, Hartford in the lead again by fifty per cent. Five Massachusetts cities, including Boston, Worcester, and Lowell, average $1.16 for all relief, against our $2.07; and 24 cents for outdoor relief against our 90 cents. Five other New England cities, including Providence and Bangor, average 33 cents for all relief, against our $2.07; and 12 cents for outdoor, against our 90 cents. Four New York cities—New York, Brooklyn, Buffalo, and Albany—average 63 cents, against our $2.07; and 43 cents, against our 90 cents. Five cities in Pennsylvania and Maryland, including Philadelphia, Pittsburg, and Baltimore, average 38 cents against our $2.07; and 4 cents, against our 90 cents. Seven Western and Southern cities, including Chicago, Cleveland, Detroit, Milwaukee, and Charleston, average 62 cents for all relief, against our $2.07; and 17 cents, against our 90 cents."

A similar comparison extended by the committee to the principal cities of Europe, including Berlin, Dresden, and Stuttgart, showed that here again Hartford led them all. In short, it appeared to be proved that Hartford was spending on the poor more money per capita of population than any other city in the United States, and more than any other in the world, with certain exceptions in Italy, and the noteworthy exceptions of London, $3.75 per capita, and Paris, $3.66 per capita. Hartford, however, outranked even London in its percentage of pauper population, which was 6.2 in Hartford, against 2.46 in London. While in Hartford every sixteenth person was a recipient of municipal bounty, in London the proportion was only one in forty. Paris led all, with one in eight.

Investigation of the causes of this deplorable state of affairs revealed an astonishing understanding between the paupers and the officials. Tramps were given residence and support for the sake of their votes on election day. Grocery stores were practically subsidized. Families whose individual members could be made useful politically were supported in outdoor relief.

That the showing was so much better for New York and other great American cities was not a proof of greater honesty or wisdom of administration on the part of municipal officials. The difference was almost wholly due to the enormous extension of private as over against public charity outside of typical New England Commonwealths like Connecticut, where the town method of dealing with such matters still holds its own against other forms of philanthropic enterprise. Proof on this point would be overwhelming were we to take the necessary space to present it. One has only to go through the annual reports of the New York State Board of Charities and read the exposures that have repeatedly been made of the state of affairs on the islands of the East River and in the county almshouses of the State to satisfy himself that were the whole burden of supporting the pauper population of this Commonwealth, and especially of this city, thrown upon the public, private enterprise withdrawing from the competition, the appropriations mentioned by Mr. Coler would sink into ridiculous insignificance by comparison. The appropriation of public money to private institutions has become a scandalous abuse, but we shall never understand its strength until we frankly face the fact that the public has been experimenting with it, hoping thus to find a way of escape from the greater abuses that attend the administration of public relief by public agencies except when they are incessantly watched and held up to the broadest light of publicity by the disinterested efforts of private citizens.

The omission of this side of the matter from Mr. Coler's discussion may perhaps be regarded as a mere failure to deal with the whole of a very large and difficult problem. But it is more than a mere omission; it is, I think, a positive error, and a serious one, into which the comptroller falls when he lays as much stress as he does upon the expenditure, for salaries and wages, of a large proportion of the sums appropriated by the city for private institutions. The real question here, as all sound experience has repeatedly demonstrated, is not whether the expenditure is for salaries in general rather than for relief. This Mr. Coler practically admits when he says that a great deal of money spent for relief is worse than wasted, because it fosters pauperism instead of repressing it, and when, at the close of his article, he says that he found it necessary to create in his department a bureau to investigate the character of institutions asking aid. This is a frank confession that the expenditure of money for salaries or for wages may be wiser than its expenditure in relief, provided the salaries or wages are earned in actual investigation, which results in exposing fraud and preventing expenditures on improper applicants. This is the very kernel of the whole matter, whether it is a private or a public administration of charity that we are considering. The use of money, public or private, for the payment of salaries that are mere sinecures is dishonesty pure and simple, and neither the comptroller nor any of those private organizations that make it their business to watch and criticise administration can have a more imperative duty than that of putting an end to such corruption. But, on the other hand, there could be no better index of positive progress in solving the practical problems of charity than a steady increase in the ratio of expenditures in salaries and wages on account of investigation and prevention to the amount spent in actual relief. That, in fact, would be an ideal administration of public and private charities in which the efficiency of investigators and the practical sagacity of relieving agents was so high that nearly the whole sum expended had to be charged to their salary account.

This is precisely the principle which private organizations like the State Charities Aid Association and the Charity Organization Society have labored in season and out of season to make the public and the officials comprehend. Innumerable exposures of the impostures practiced upon a credulous public by the great class of professional mendicants, tramps, and place seekers have furnished all the evidence that sensible men need to satisfy themselves that large sums expended by the public and by private individuals of charitable proclivities have no other result than that of encouraging pauperism and misery. It is largely due to the tireless efforts of the State Charities Aid Association for many years past that the institutions receiving public moneys in this State have been watched with such vigilance that there is now a strict system of accounting in all of them, and that it has become the duty of the State Board of Charities not only to insist upon such accounting and to carry out a thorough inspection, but also to frame and enforce rules for their government.

These criticisms I offer, however, only because, as I said at the outset, I desire to see the fundamental proposition of Mr. Coler's statement strengthened and made to bear practical fruit. It is indeed a very serious question whether the appropriation of public money to private institutions has not become so great an evil that it would be better to put a stop to it once for all. And yet I must confess to a doubt whether, upon a complete survey of all the facts, this would be the judgment of the most practical and far-seeing men. The granting of appropriations gives to the city and the State a reason and an excuse for a strict inspection of organizations that otherwise might do incalculable mischief by preying upon the credulity of a generous public while concealing their actual operations. I therefore am inclined to think that the path of practical wisdom lies through an attempt to perfect the existing co-operation between public and private agencies, and to bring it to a sounder business basis by developing inspection, publicity, and accountability. If private organizations are encouraged to do all in their own power under a system wherein the State grants them aid under strict conditions, lays down necessary rules for their government and guidance, and remorselessly exposes all their transactions, the actual result may be better in the long run than if State and private associations proceeded independently of one another, often duplicating each other's work, or, if not that, working at cross-purposes.

RECENT LEGISLATION AGAINST THE DRINK EVIL.

By APPLETON MORGAN.

FIVE years ago it was sought in these pages * to discover the cause or causes of the total failure in the United States of prohibitive legislation.

Our conclusion, so far as a conclusion could be said to have been reached, was that the failure lay in the misapplication of ways to means, rather than of means to ends—namely, that an attempt to abolish the crime (or misdemeanor) of drunkenness by punishing, not the criminal, but the community in which he committed the crime, and to prevent law-breaking by legislating out of existence the neutral instrument which happened to form the particular temptation to the particular law-breaker (or with which he found it convenient to commit the crime), was quite too logical to be practicable; as, for instance, laws abolishing the use of spoons, as so many temptations to housebreakers; or of railways, because trespassers on railway tracks were often killed; or steamboats, because steamboat boilers sometimes burst, would be quite too logical for public convenience. Whence it followed that there was no demand for prohibitive liquor laws, and therefore only failure had resulted from attempting to enforce them.

In the five years since that paper was printed almost every one of the United States (in fact, all, with but one exception) have recognized such failure and striven to so recast each its statutes as to plant the responsibility for breach of public order upon the real offender without hardship to the law-abiding classes. The results of these attempts have evolved many novel and unusual contrivances and much curious operation of statutory and statistical wisdom, and some remarkable propositions—so much so that it is believed that an effort to digest them (not by States, but by the principles, or rather by the remedies, attempted) will be interesting consideration for readers of the Popular Science Monthly. If the following summary shall develop two apparent paradoxes—first, that the fewer the places where liquor is sold the larger the consumption of liquor; and, second, that the larger the consumption of liquor the less drunkenness—the present writer can only submit that these para-

* The Popular Science Monthly for February, 1894.

doxes are not his own, but seem to arise from the official statistics submitted under the oaths of the authorities commissioned to collect them, as hereinafter will more fully appear:

Of the forty-nine States and Territories in the United States, the solitary exception above noted is the State of Maine. With a heroism that is actual martydom of self-interest and convenience, the State of Maine has clung with imperious tenacity to her policy of absolute prohibition, and to the logic of the report of her citizen, who, sixty-three years ago, carried her first prohibition law through her Legislature. Said that report: "The objection will doubtless be made that had we such a law it could not be enforced. Now, admit the validity of this objection, and it proves the utter hopelessness of the case; for no one, we presume, will venture the supposition that you can accomplish, against law, that which you could not effect with it." *

Admitting, as all the world does admit, that the abolition of drunkenness is desirable, against such pitiless, such iron, logic as this, there is no appeal, and from it there is no escape even to-day. But the trouble was, and is, that it is placing an entire Commonwealth in time of peace under martial law. It was in the fitness of things that General Appleton, a soldier, who had seen intoxication in a form most likely to impress him with dangers to the public—i. e., in soldiers to whom the safety of the State in time of war was intrusted—should have brought in the first prohibition law on record;† and that, in the teeth of more than two generations of failure, the sovereign State of Maine should have adhered to his martial logic, with the loss of her commerce and the reduction of her census, is a tribute to both the logic of a soldier or the self-insistence of the State which must compel admiration! In sixty-three years Maine has seen her commerce disappear and her population dwindle. She has seen not only her contemporary sister States, but those admitted yesterday and the day before, pass her in affluence and prosperity. But the only remedy for her failure she will listen to the suggestion of is an inreased severity of prohibition statutes and an increased crucifixion of her law-abiding citizens, lest one of her own or a single stranger within her gates should obtain a glass of alcoholic compound within her borders.

But, cling as the State of Maine may to the fierce logic of prohibition, it appears that her forty-eight sisters have found its unappealable rigor too rigid, and have modulated it in the divers ways now to be considered.

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* Report of General James Appleton to the Legislature of Maine, July 15, 1837.

† General Appleton was commander of the First Brigade of the Second Division of Massachusetts infantry in the War of 1812–1815, his resignation dating 1828.

In these remaining forty-eight States and Territories of the Union the statistics regulating liquor seem to divide themselves, as to the remedies attempted, into ten heads, as follows:

I. Abolish all liquor laws except those for revenue.

II. Example.

III. Education.

IV. Government control of all warehousing and sales.

V. Regulation of hours for retailing liquors.

VI. Refusal of employment to drinkers. Change of pay-day.

VII. Personal damage law.

VIII. Encourage the use of light wines and beers; remove all duties or imposts on food products; quality inspection.

IX. High revenue—national, interstate, or State.

X. Local option.

For No. I, pure and simple, we have but a single report, perhaps (as of a frontier State) not exemplary, or safe to guide the more interior States, but given exactly for what it may be worth. The Governor of Montana (a State which boasts the bad eminence of having proportionately more liquor-sellers paying license fees than any other State in the Union—having, in fact, one licensed liquor-seller to every fifty-five inhabitants) reports as follows:

"Saloons are run wide open night and day; while there is a great deal of drinking there is very little drunkenness, and one in an intoxicated condition is promptly arrested and fined." One other State, however (Louisiana), has the continental idea that liquor laws are for "revenue only." Louisiana, therefore, has an elaborate excise, guiltless of any suggestion of reformative objects. So far as her statistics go, she is the most temperate State in the Union.

II. Example.—This may be called the apostolic cure—the one laid down by the apostle St. Paul (I Corinthians, viii, 13)—though we find a prominent English ecclesiastic, Dean Hole, on being asked if he was not aware that people ought to abstain for the sake of their example to others, replied: "I have never seen any one converted by example. I have often challenged teetotalers to produce Mr. Jones converted by the example of Mr. Brown, but I am waiting for him. I don't see why I should make a fool of myself because others do." I should not deal with the matter quite so summarily myself. Doubtless the example of a thrifty, wholesome, prosperous laborer, if left (without exhortation or impertinence of third parties) to work upon his dram-drinking, wretched neighbor, might have its laudable effect: such example not being deprived in advance of its value by the fetters of a written pledge which a man's personal pride might force him to ostentatiously observe—or if the exemplary person does not get his living by denouncing liquor—or by the coercion of a Ladies' Temperance Union! But as the person converted by the example would be certain not to parade the fact, no statistics could even then be attainable. The case or cases, if genuine, would be hidden in the consciences of the converts and beyond any marshaling in figures. All we can do is to hope and trust that our good examples may prevail, and that, like the apostle St. Paul (whom our British ecclesiastic begs to differ with), there may be some among us strong enough physically as well as spiritually to say, "If meat make my brother to offend, I will eat no meat while the world standeth."

These considerations have not, however, deterred certain States from ingrafting example upon the statute-book, as nearly as it could be made a subject of legislation, by enacting that there shall be held before the eye of the possible drinker the spectacle of his neighbors drinking rum: trusting, doubtless, to the rum itself to work a condition in the drinker to afford the example required, and so add to the unestimated but hoped-for good example to bad example at hand. Three States—i. e., Indiana, Michigan, and Utah—and the city of Atlanta, Georgia, by municipal ordinance, provide that the premises on which liquor is retailed by drinks shall have no screen or other obstruction before its windows, so that passers-by may see the drinking which goes on therein and its horrible accompanying circumstances. The reports from these States, however, are not such as to commend this policy of example to universal acceptance.

III. Education.—Within the past four years several States—Wisconsin, Ohio, New Jersey, Nevada—have enacted statutes providing that pupils in the public schools should be particularly instructed in so much at least of the science of toxicology as relates to the uses and abuses of alcohol, and of its effect upon the human system. Such instruction, if honestly imparted by capable teachers and by honest text-books, can not fail to be of the highest value. Capable teachers and honest text-books could not possibly teach, for example, that alcoholic liquors were an unmixed evil, could not deny their medicinal value, or their stimulative aid in fortifying against disease or exposure, or in supplying the waste of age; could not teach (as I gave instances of of fanatical teachings) that it were better to die for the need of a glass of whisky than to have one's life saved by the use of it, or that the use of liquor "destroys both body and soul" (in the teeth of the facts that only the most flagrant and protracted abuse of liquor ever, and that after a long term of years, destroyed a human body, and that statistics as to the soul are not attainable). Much is to be hoped for under this benign instruction. It is not possible that our youth will not miss to acquire much important information, such as that "wine is a good servant if well used"; that total abstinence is a regimen only to be pursued by advice of a physician; that the vast majority of human beings can and do partake moderately of alcoholic liquors, not only without injurious consequences, but with positive benefit; and that, as it is a source of much enjoyment, and much discomfort often springs from its discontinuance, it is difficult to say why such use should be discontinued under ordinary circumstances. Our youth will learn, too, that there are many nations that thrive without alcoholic drinks—nations, for example, professing the Mohammedan faith, to whom alcohol is forbidden by their religion; but that among them the use of stronger narcotics, such as opium and Indian hemp, is extremely common, and the exchange from alcohol to these narcotics can hardly be looked upon as a gain. The result of this State instruction may be confidently looked for, and can not possibly do harm. It is too early as yet to procure data for discussion of the amount of good accomplished by this legislation. We must wait until the adolescent pupil has grown to man's estate, to middle age, until his mortal change, and search his record, and the record of the family he leaves behind him, for the benefits of the paternal legislation. In short, it is exceedingly doubtful if data upon this subject, in the nineteenth century at least, will ever be collected at all. It is noticeable, however, that in the States' scheme of education the peripatetic temperance lecturer, with his lurid colored charts of the human stomach in the horrors of suffering from what he calls "the flowin' bowl," have no place, and no salary is provided for such "university extension" processes. A suggestion lately made in these pages that temperance lecturers as well as liquor dealers being obliged to take out licenses (at least as caterers to the public amusement) is conspicuous by its absence from the educational plan.

IV. Government Control of Traffic.—The idea of a government monopoly in liquor is from continental Europe, and, like most ideas from that source, is paternal and monarchical pure and simple. The idea reached perfection in what is known as the Gothenburg system, which, attracting considerable attention from students of the liquor problem, was introduced into the statutes of Georgia, where after a brief trial it was discarded. The State of South Carolina, however, adopted its principal features, calling it the "dispensary system," and is still maintaining it.

The story of the Gothenburg system is as follows: Since the days of Gustavus Adolphus III there had existed in Sweden and Norway a policy making the distillation of a liquor called *bränxin*, or brandy, a right running with the ownership of land first, afterward with a tenancy of land, and ultimately a right secured to tavern-keepers. This brandy being distilled from grain or potatoes, and containing about fifty per cent of alcohol, was cheap, and in consequence of the poor food supply grew into universal use, until not only men and women but very young children drank it. Drunkenness became the rule, and pauperism and crime prevailed in startling proportions, outrunning the range of either charity or police to control them. In this state of affairs a Dr. Wisselgren, Dean of Gothenburg, a Swedish city, arose, and from his exertions grew the famous Gothenburg system.

Stripped of detail, this system provides that stock companies called brandy companies shall receive from the crown a monopoly of liquor sales, on condition of maintaining eating houses, reading rooms, lodgings, and other conveniences for the community, and out of surplus profits contribute to the police, the poor, and the educational, funds of the community. The companies shall be under inspection of the royal governor, with no appeal from his discretion, and also under inspection of officers of the three funds entitled to the surplus profits. The companies must close their places of sale on Sundays, can sell only to persons over eighteen years of age, and in the rooms devoted to drinking alone there must be no chairs or settees. After drinking, the purchaser must depart. Such rooms must not be in communication directly with the eating and lodging rooms. In these latter cleanliness and cheapness must prevail, but the company may raise the price and dilute the strength of the brandy sold.

With much amendment and revision, this system appears to be to-day substantially in effect, with what good results opinions differ. It was speedily rejected after brief trial in Georgia for a high-license system pure and simple. In South Carolina its introduction from Georgia provoked riot and even bloodshed on account of the right of search which it involved. The main feature is, of course, that the State becomes the real buyer, jobber, and retailer of all ardent spirits. Here it has been found difficult of complete administration, and, unless its success should be more distinguished than at present, it probably is but a short-lived expedient.

V. Regulation of Hours of Sale.—All the liquor-licensing States and Territories regulate the hours of opening and closing drinking places. They all agree in closing them during the small hours (that is, from midnight or one o'clock a. m. until about sunrise or an hour after). It is difficult to all what effect for good or ill these statutes can have upon either the decrease of drunkenness or the increase of revenue. Doubtless they are convenient for the public force of cities or the constabulary of the smaller towns, so that they may know when to be prepared for possible breaking of the public peace. But in no State, so far as we can discover, are they applied to Sunday, the day when, in large cities especially, and in the heated season, the inconvenience of hermetically closed ale and beer houses is most exasperating to the wayfarer, and intolerable and even (from a sanitary standpoint) dangerous to the wage-earning and poorer classes, packed in torrid and fetid tenements on the figment of a danger of "disturbing a public worship" (I say "figment" because no instance of a disturbance of public worship by the sale of liquor can be found in the history of this planet). Why in torrid weather the worthy poor man and his family who can not afford ice-boxes can not quench a natural and normal thirst, and so avoid contracting disease by drinking stale and impure water in the superheated apartments of city tenement houses where an average of three families to a window pane has been said to be the rule, I for one have never been able to comprehend. A good Sunday law, as in London, not allowing but compelling the opening of beer houses on certain hours on Sundays, would be a most desirable thing, especially in our great cities. The fact, too, that at present the streets of our American cities are woefully lacking in other sanitary conveniences, which are only supplied meagerly by an occasional drinking place, would appear an additional reason why a Sunday-opening law would be quite as convenient and quite as welcome as a Sunday-closing law. Such a law would have the effect of at least meeting public convenience, and might well be substituted for the present ridiculous closing laws. Into what legislative intellect it ever first entered to conceive that the cause of temperance would be assisted by closing liquor saloons seven hours out of the twenty-four (and those seven the hours when all Nature, drunk or sober, is asleep) it passes imagination to conjecture. Most Legislatures have followed the first one, however, and enacted such provisions.

VI. Refusal of Employment to Persons known to be Habitual Users of Liquor.—In two States—viz., New York and Ohio—clauses have been introduced forbidding the employment by railways and other common carriers of passengers, of persons known to be addicted to the use of intoxicants. In the latter State the common carrier must be notified that such person has been known to be intoxicated while in said carrier's "active" employment, in order to bind the carrier with knowledge. Such a provision as this may be criticised as the Czar of Russia's proposition for a universal disarmament is likely to be criticised—as admirable and millennial, but of no value if gradually adopted, and impossible of instant adoption. No public industry, not even the liquor industry, could cease and disappear in a day without throwing tens of thousands of wage-earners out of employment, and it would be hardship indeed if the family of the drinking man, the toiling wife, scheming to save a morsel of the weekly wages from the dram shop, should be forced to accept the alternative of no wages at all. The suggestion presents, again, a maze of presumption from which, once entered into, no practical exit would present itself. Supposing that no skilled laborer, no finisher, no engineer, no oiler, no fireman, etc., could be found who was a total abstainer for any one factory or railway service, let alone a hundred or a hundred thousand cases? Clearly this discussion could only be pursued as a curiosity (or, say, a fascinating speculation as to the effects of an industrial chaos). The first item in the recipe for making hare stew was to catch your hare. To run our commerce with totally abstaining employees we must find our totally abstaining employees. To pause to create them would bring commerce, and with it society, including the churches, the schools, and the Temperance Unions themselves, to a standstill like that of Joshua's moon in Ajalon! In connection with this employment question, however, a practical suggestion has been made. It is suggested that, as Saturday night is the workman's "night off" and the ensuing Sunday is his holiday, it might work well to make the weekly pay-day of a Monday instead of a Saturday. The experiment is worth a trial. The change could be made abruptly, and the bad half an hour to the workman would occur but once. Let him be handed his wages some Monday morning when the Saturday night's spree and the long Sunday's headache had been novel and conspicuous omissions. The necessity of good shape for Tuesday's stint would prevent a Monday night at the bar room, and the probability is that the wife and family might realize a substantial instead of a marginal proportion of the weekly wage. At any rate, compared with some of the suggestions made for remedying the drink evil, this is superbly sensible. Indeed, one who has not had occasion to examine these matters can have little idea of the absurdity to which otherwise perfectly sane persons will go in combating an evil with which they are very properly impressed, but to the consequences of an abrupt removal of which it has not occurred to them to pay any attention whatever; for example, the seriously proposed law against "treating" —that is, against inviting a friend to "take a drink" with him. Granted that the tippling habit is encouraged by the social instinct, and that the great peril of drunkenness comes (as an old New England farmer expressed it) "not from drinkin', but from drinkin' agin," a law to prevent treating, like a law forbidding a man from inviting his neighbor home to dinner, or his wife inviting the other man's wife over to luncheon, would be obliged to first find its lawgiver. But gentlemen who solve the liquor question are not apt to be particular to find a jurisdiction and a source for the laws they propose. It is interesting to note that in one State

(Nevada) an anti-treating law was once actually passed, but repealed, "having proved impracticable" (at least, that is the official record of the reason for its repeal, no particulars being given).

VII. The Personal Damage Law—that is, the holding of a seller of liquor to a person known to be dangerous when in drink responsible for damage caused by his intoxication. This principle has now become ingrafted in the laws of seventeen of the United States, sometimes coupled with high license and local option and sometimes not. It is really only an application of the principle of the common law that a man must so use his own as not to injure his neighbor; that communities had the same right to hold a supplier of intoxicants to a violent drinker as a criminal as it had to punish the keeper of a dangerous beast (of a biting dog, for example, knowing it to be such—i. e., if the animal has once bitten a human being or killed a domestic animal kept for revenue, as a cow or a sheep). This civil damage law has been made statutory in many ways. In Ohio the seller is held indefinitely for the "expenses of any one who takes charge of the intoxicated person" after notice to the seller not to sell to that person. In Michigan the damages may be exemplary. In Vermont, if the drunkard is imprisoned the seller must pay two dollars per day to his wife or minor children in addition to suffering an imprisonment. In New Hampshire and Nebraska, and in several other States, a person arrested for drunkenness is given his liberty if he will disclose the name of the person who sold him the liquor on which he became intoxicated. In most of the other States (as in New York) the damages are not limited except by the facts of such case. In New York, too, the preliminary notice is insisted on. In other States (as Idaho) the seller's damage is the loss of his license, if notice not to sell has been properly served upon him. In Arkansas the liquor seller as a condition of his license must give a bond to pay all damages awarded. In Nebraska the seller must give a bond to support all widows and orphans, and pay all legal expenses of prosecution as well as all damage resulting from any intoxication induced by or traceable to his sales.

VIII. Encourage the Use of Light Wines and Beers.—The suggestion has often been made that this would undoubtedly solve at one swoop a respectable proportion of the problem. The practical difficulty would be to institute the reform in any but the cities and larger towns. Everybody has remarked that, to see the true and distinguished squalor of drunkenness, one must seek the villages, sparsely settled communities, the rural districts whence come the "come-ons," the willing victims of the green-goods men, anxious to cheat their Government (and so, one might say, at least a shade less estimable than the sharper who only proposes to cheat a fellow-citizen). It seems to me that the reason for this difference lies distinctly in the fact that the countryman, who will gratify his appetite for drink, has no choice but the concoction of ardent spirits, high wines, or whatever it is which the local publican sets before him. To him the word "wine" suggests a luxury beyond his venture or his purse. And so for the price at which, in a large city, he could obtain half a bottle, or even a bottle, of wholesome red wine, the consumption of which at a settling would do no possible harm, he throws into his stomach a glass of biting poison, and, horrible to relate, another and another; whereas the whole bottle, or at least the half bottle, probably shared with a neighbor, would have satisfied his craving without ruining his digestion or stealing away his brains. This clause of our discussion runs largely into our IX. But meanwhile here are some figures which may startle prohibitionists as completely as did the figures given in these pages four years ago, which went to prove that habitual drunkards lived longer than total abstainers. (These figures have been strenuously denied in declamation and denouncement. I have yet to learn that any attempt has been made by industry in collection of counter-figures to demonstrate their fallacy.*) But here are certain other figures: It appears by the official report of Dr. Nagle to the Health Department of the city of New York for the first thirty-one weeks of the year 1893 (the city then prior to the consolidation or to the present "Raines" law) that in the community (as it then was of 1,765,645 inhabitants) out of 29,080 deaths only twenty-nine were directly traceable to the use of liquor. And this in a community where 10,749 liquor saloons were in operation from sunrise to midnight daily, not to mention the use of wines and liquors in hundreds of hotels and clubs and of wines and malt liquors on tens of thousands of private tables. These figures are startling, and read quite as extravagantly as those quite to the reverse conclusion with which the prohibition-

* Perhaps for convenience of reference the figures heretofore found so startling may be repeated. Of 4,234 deaths collected by the British Medical Association, divided for reference into five classes—namely: *a*, total abstainers; *b*, habitually temperate; *c*, careless drinkers; *d*, free drinkers; *e*, habitual drunkards—the ages of death of those in each class were registered, together with the causes of death; and the average of death for each class computed with the following result:

Total abstainers lived on an average....................	51.22	years;
Habitually temperate lived on an average...............	62.13	"
Careless drinkers lived on an average....................	59.67	"
Free drinkers lived on an average........................	57.59	"
Habitual drunkards lived on an average.................	52.03	"

To cancel such a statement as this, some industry is required on the other side; at least a collection of 4,234 other cases. Anybody can say that a laboriously tabulated statement is false. But it requires patience to demonstrate it.

ists are wont to appall us. But they are from the official sources, and, unlike the awful figures which show a larger mortality from the use of liquor alone than the mortality from all known causes (liquor included), can be verified by taking the trouble to consult the files of the (New York) City Record. As for the part which drinking wine has to do with this official summary, I may mention the difficulty of approximating to the sales of what may be properly called "light wines." But I have been able to ascertain (as some indication of it, perhaps) that in the fifty-two weeks of this same year (1893) there were consumed in the same city 265,414 cases of champagne! So it would appear that even champagne is a mitigant, rather than an aggravator, of at least the public horrors of drunkenness.

I am not unconscious of the fluent answer to these figures. It will be of course urged by the prohibitionist that they only show deaths the "direct" cause of dram-drinking. But such answer is correspondingly unsafe. For, since death, albeit normal to us all comes from some cause (notably from old age, for example), a better formula would be that, since many deaths are caused by old age, and as old age is caused by living too long, we should be careful not to live too long. Hence, as life is prolonged by eating, as well as shortened by drinking (granting that contention), to abstain from the use of food is the only course of wisdom!

This encouragement to the drinking of light wines has, so far, only positively found its way into the statute-books of the one essentially wine-growing State, California, though in other States it has made its limited appearance. Nor does there seem to be any reason why every State should not include in its laws such a provision, for example, as that of Oregon (certainly not known as *per se* a "wine-growing State" at present), which provides that "owners of vineyards may sell their products without license"; or of Utah, which, however, adds to a similar provision that the sale must be in quantities not less than five gallons. Even Kansas provides that wine or cider, grown by the maker for his own use or to be sold for communion purposes, is not within the prohibitions. However, as in most of the States, the price of a license to sell only wines, or wines and beers, is less than the price of a license to sell ardent spirits, it may fairly be said that an encouragement to drinking wines in preference to distilled liquors has become parcel of the public policy in most communities. In Georgia the sellers of wines who are also manufacturers thereof are exempted from paying any license. The State of Michigan is justly proud of its Dairy and Food Commission, which provides for the examination and secures the purity not only of fruits, butter, milk, cheese, but of buckwheat flour, jellies, canned goods, lard, vinegar, coffee, sirups and molasses, chocolate, cocoanuts, baking powder, flavoring extracts, mustard, and other spices. And this same law (elsewhere considered as to adulteration of liquors) seems to encourage light wines by a distinct provision that " the blending of liquors will be permitted if spirits or other ingredients are not added." In Rhode Island, if manufactured from fruit or grain grown in the State, no license is required for the manufacture of cider, wine, or malt liquors; and (with a thrift not uncharacteristic) alcohol, while subject to a heavy license for home consumption, may be produced for exportation without any license at all.

IX. Remove all Duties, Taxes, Imposts, or Burdens of any Sort on Food Products, Serials, or Meats, in order that the food supply may be unfailing everywhere.

Ten years ago the Hon. Edwin Reed, of Boston, Massachusetts, published a pamphlet * in which he had the courage to say that, if a man were well fed, liquor could have no terrors for him. " Take care of the eating and the drinking will take care of itself." Repeal all laws that in any degree and on any pretext tend to enhance the market prices, was Mr. Reed's thesis, and he nailed it boldly to the Massachusetts State-House door! Mr. Reed proceeded with figures to remind us that the countries where drunkenness existed to the most alarming degrees were those countries where the masses of the people eat the least, see meat perhaps once or twice a year, and perhaps never; where the year's labor barely suffices to pay the year's taxes! —in Italy, Russia, or Sweden, and parts of Germany, for example, where life is a struggle for bread enough to keep life in the body. The figures Mr. Reed gives are too appalling for an Anglo-Saxon to read calmly. " If Russia," says Mr. Reed, " could reduce her infant mortality to that of Great Britain she would save annually a million of lives. Half the Russian mothers can not nurse their children. The whip and spur of poverty drives them to labor in the fields, where they follow the plow three days after confinement, and where the death rate is forty-eight per thousand. . . . In France many a factory hand lives on a slice of sour bread for a meal, over which he is fortunate if he can rub an onion to give it flavor. . . . In Italy, where taxes are imposed to twenty-five per cent of the laborer's income, the average length of life is twenty-seven years, and the whole kingdom is mortgaged to an average of seventeen per cent." In Würtemberg Mr. Reed assures us that " in this garden of Germany the peasant lives on black bread and potatoes with meat only once a year." And even in England Mr. Reed (quoting his authority) declares that the collier breakfasts on bread soaked in hot water and flavored with onion, dines on bread and hard cheese, with sour, thin

* A New View of the Temperance Question. By Edwin Reed, Boston, 1889.

cider, and sups on potatoes or cabbage greased with a bit of bacon rind. And precisely the identical testimony, varying only the staples of starvation, comes from Switzerland, Poland, and other countries. Now, all this requires something, and that something usually takes the form of something alcoholic. Poor Edgar Allan Poe produced his fascinating prose and marvelous poetry on dinners of herbs, and the well-fed, fat, greasy Honey-thunders and Podsnaps recognize the crime, not in the fact that such a man was left to eat such dinners, but that he took a glass of whisky to keep the life in his poor unnourished body while he wrote. Therefore Mr. Reed would make food as plentiful as Nature has enabled man to make it. In other words, a condition of unfedness requires the human system to crave alcoholic stimulants, and what the human system craves it must find, since the craving becomes functional, and impossible to disregard, *malgre* laws, systems, or statutes whatsoever. Even the children in Switzerland, says Dr. Schuler (quoted by Mr. Reed), are fed whisky between meals in order to sustain their tiny lives, the low regimen of whose mothers has given them the frailest possible hold on life to live at all. Mr. Reed believes also that, on public grounds, other effort for amelioration should be made by the State, such as shorter hours of labor, two holidays a week, etc. But as to these we will not follow him here. He makes his point, however, and his pamphlet is worth the consideration of philanthropists. It can not be denied that, with the exception of the shorter hours for labor and the general tendency to increase the number of holidays ("Labor Day," Arbor Day, Memorial Day, Lincoln Day, etc.), much of Mr. Reed's theories have got into our statute-books. And the general tendency to ameliorate the condition of the laborer, which is everywhere apparent in the United States, may fairly be alluded to here as among statutory efforts to the universal betterment.

[*To be concluded.*]

Regarding changes in the language of science, as illustrated in the English Historical Dictionary, C. L. Barnes pointed out, in the Literary and Philosophical Society of Manchester, England, that the words "astronomy" and "astrology" have interchanged meanings since they were first introduced, as is shown by Evelyn's speaking, in his Memoirs, of having dined with "Mr. Flamsteed, the learned astrologer and mathematician." Gaule, in 1652, spoke of chemistry as "a kind of præstigious, cheating, covetous magick"; and even as late as 1812 Bentham spoke of the "unexpressive appellation chemistry" as the single-worded synonym for "idioscopic or crypto-dynamic anthropurgics." Atom originally meant a small interval of time—the 22,564th part of an hour. The word gas was suggested to Van Helmont by the Greek chaos. "I called that vapor gas," he said, "an ancient mystery not long from chaos." Algebra was a branch of mathematics and also the art of bone-setting, and both meanings are still used in Spain.

TEACHERS' SCHOOL OF SCIENCE.

By FRANCES ZIRNGIEBEL.

"HE who would most effectually improve school tuition must find out the most effectual way of improving the teachers. Hence he is the greatest educational benefactor who does most to raise the character and qualifications of the teachers," said John D. Philbrick, late superintendent of the public schools of the city of Boston, in his twenty-third semiannual report. By providing teachers with the best instruction on subjects the teaching of which was at the time of making this report, and is still, unsatisfactory, The Teachers' School of Science of the Boston Society of Natural History has for nearly three decades been a great educational benefactor. It stands unique as an institution which, while doing a great work for many years, has presented nothing of startling nature such as would attract the attention of the general public, and is therefore not so widely known as it deserves to be.

ALPHEUS HYATT.

During a conversation held at the council room of the Boston Society of Natural History, in 1870, between Prof. Alpheus Hyatt and the late Mr. John C. Cummings, a Boston merchant interested in natural history and curator of the plant collection of the society for twenty odd years, the latter expressed regret that the Lowell lectures for teachers had been discontinued. Professor Hyatt then suggested to him a plan for lectures for teachers exclusively. That afternoon Mr. Cummings gave five hundred dollars for the commencement of such a course, and soon after the matter was brought before a committee consisting of Mr. Cummings, Professor Hyatt, and Professor Niles.

Under the direction of the committee the courses of lessons were given as follows: physical geography, by Prof. William H. Niles, of the Massachusetts Institute of Technology; mineralogy, by Mr. W. C. Greenough, of the Providence Normal School; zoölogy, by Prof. Alpheus Hyatt, then custodian of the Boston Society of Natural History; botany, by Dr. W. G. Farlow, of Cambridge—in all thirty-three lessons. These courses were wholly tentative and experimental, but attained success that was most encouraging.


John Cummings.

Through the kindness of Professor Runkle, President of the Massachusetts Institute of Technology, Huntington Hall, in which so many great scientists have spoken, was opened for the first lesson in geography. Professor Niles here delivered six lectures. "He undertook to give the more general features of the earth's surface, and then to apply these general principles to the explanation of the physical characteristics of Massachusetts." The success of this course may be judged by the average attendance, which was about six hundred teachers of all grades, and by the fact that the teaching of geography in some of the public schools at once underwent a change in favor of the more natural method introduced by him.

"On account of the necessity of actually handling and dissecting specimens, the tickets issued for the succeeding lessons were limited, and at the six lessons on mineralogy and eleven on zoölogy there was an average attendance of about fifty-five. The materials for the course in zoölogy were gathered in sufficient abundance through the extraordinary facilities for collecting marine animals afforded by Prof. S. F. Baird, United States Commissioner of Fisheries; those for the course in botany were furnished with equal readiness and generosity by Prof. Asa Gray from his botanical garden at Cambridge."

The society's attempt to introduce natural history into the public schools met with favor at the hands of the superintendent, Mr. Philbrick, and a committee of school principals was appointed, with Mr. James A. Page as chairman, who canvassed the teachers regarding this matter. Accordingly, in October, 1871, a circular was sent to teachers which said that lessons were to be given by "professors familiar with the object methods of teaching and skillful in the use of chalk." Seven hundred teachers signed this circular, and so signified their pleasure at the prospect of receiving such instruction.

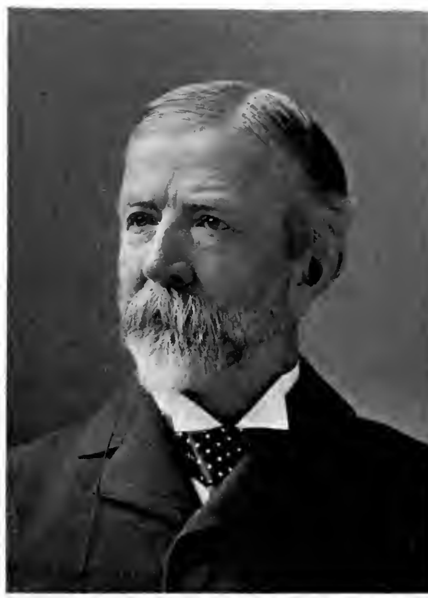
While Mr. Cummings was generously providing these courses of lectures exclusively for the benefit of teachers, Mr. John A. Lowell, trustee of the Lowell Institute Fund, made liberal provision for free courses on different branches of natural science, to which teachers were specially invited and which were well adapted to their wants, although not intended exclusively for them. During the winter of 1872–'73, on account of the large fire in Boston and the absence of Professor Hyatt in Europe, the lessons in The Teachers' School of Science were necessarily suspended. In the autumn of 1874 they were resumed and supported by renewed donations from Mr. Cummings. Mr. L. S. Burbank gave thirty lessons on minerals, and distributed the specimens used at the lectures among the teachers. These minerals were then used in the schools

On the right, Building of the Boston Society of Natural History; on the left, Rogers's Building of the Massachusetts Institute of Technology.

for instruction. This was virtually the introduction of the teaching of natural science in the public schools of Boston. The following winter Mr. Burbank continued his teaching by giving fourteen lessons in lithology to a class averaging ninety in attendance. One hundred sets of seventy-five specimens each were distributed, and many of these sets placed in collections of the city schools. "A supplementary course of field lessons about Boston was voluntarily conducted by Mr. Burbank, who had in his class this year seventy-five per cent of the members of the class in mineralogy of the previous year. This class included a large number of the busiest teachers of Boston and vicinity, and each member of the class was provided with tools, consisting of a small hammer, magnet, file, streak stone of Arkansas quartzite, a bottle of dilute acid, a glass rod, and the scale of hardness previously used in the mineralogical course."

In 1876 women were admitted to the Society of Natural History, and in that way further privileges were granted to teachers. As in previous years, through the liberality of Mr. Cummings, the lessons were continued, and a course of twenty-one lessons in morphological, physiological, and systematic botany was given by Prof. George L. Goodale, of Harvard University. Each lesson was illustrated by specimens which were distributed to the students. The analysis of the flowers and the determination of the peculiarities of floral structure were considered by Professor Goodale an important part of the course. For this purpose blank forms were distributed to the teachers, which enabled each one to pursue his examination of the flower in hand independently, and made it possible for the instructor to cover more ground than would have been practical by any other method. There was an unusually large attendance at these lessons, averaging one hundred. The following year Professor Goodale continued to teach in the school, giving twenty lectures on the principles of systematic botany. Printed synopses of the lectures were placed in the hands of the teachers, and nearly all the large orders of plants were illustrated by specimens or diagrams. The teachers were also provided with dried and named specimens of native plants suitable for private herbaria. About one hundred and fifty sets of these plants were distributed during the course, at which the attendance was even greater than that of the previous year.

It was at this time that, through the efforts of Miss Lucretia Crocker, the study of zoölogy was introduced into the high schools of Boston, and the study of Nature in the public schools took a definite form. At this time The Teachers' School of Science attained an extraordinary size and importance, a development which was sudden and unexpected. The supervisor of Nature study, Miss Crocker, assured the directors of the school that their assistance would be of great benefit, and in fact essential, to the success of the introduction of this subject into the schools. It was therefore determined to institute appropriate courses upon elementary botany, zoölogy, and mineralogy, if the means of paying the expenses could be raised. Mrs. S. T. Hooper and Miss Crocker undertook a considerable amount of the necessary work, and fortunately their scheme met with substantial appreciation from Mrs. Augustus Hemmenway, who subscribed most liberally, and they were assured of further support and interest. Obstacles arose on account of the number of applicants and the necessity of providing identical specimens for all. The association and sympathy of Mrs. Elizabeth Agassiz with the undertaking was particularly gratifying, since Prof. Louis Agassiz was the first naturalist who ever taught the popular audiences in this country with the specimens in hand. Large sums of money were contributed by women, many members of the Natural History Society, and the teachers themselves joined in making up the necessary fund. The Institute of Technology generously gave the use of Huntington Hall upon the payment of a nominal sum for cleaning and heating. Count Pourtalés, Dr. Hermann Hagan, and Mr. E. C. Hamlin, of the Museum of Comparative Zoölogy, which was under the direction of Mr. Alexander Agassiz, at various times assisted by donations from their respective departments. Further assistance in various ways, such as the drawing of zoölogical charts, preparations of models, and donations of specimens, was received from other persons. There were six hundred and sixteen applicants for this winter's course, and the number of specimens distributed did not fall short of one hundred thousand. After an introductory lecture, at which the Superintendent of Public Schools, the President of the Society of Natural History, and the custodian, delivered addresses appropriate to the occasion, Professor Goodale completed a course of six lessons on botany, in which he instructed the whole audience of five hundred. These lessons were followed the same year by twelve on zoölogy by Professor Hyatt, and five on mineralogy by Mr. Burbank, which ended with a geological excursion to Marblehead. These lessons were given to very large classes, and were supplemented by the issuing of pamphlets under the general title of Science Guides. Three numbers—About Pebbles, by Professor Hyatt; A Few Com-



George L. Goodale.

mon Plants, by Dr. Goodale; and Commercial and Other Sponges, by Professor Hyatt and others—were published by Messrs. Ginn and Heath, who have since brought out many such helps.

After a winter of intense activity there came a period of repose, and no lectures were given the next season. After lying quiet for a year the school once more came into active operation. Mrs. Quincy A. Shaw and Mrs. Augustus Hemmenway showed their sympathy with the efforts on behalf of education by most generously assuming the whole expense of the lessons given that year. Immediate measures were taken to carry out the plan which had been arranged several years before, which consisted in giving a series of lessons which would be a good preparation for a course in physiography. Accordingly, Professor Cross, of the Institute of Technology, was engaged to give eight lessons in physics, Professor Hyatt following with eight on the physical relations of animals to the earth; Professor Goodale gave four treating of plants in the same way, and Mr. W. O. Crosby concluded the course with four lectures on the relations of geological agencies to physiography. The applications for tickets to these lectures so far exceeded the expectations of the committee that they were forced to duplicate them, each speaker repeating his lesson on the same day before a different audience.

After this the work of The Teachers' School of Science was taken under the protection of the Lowell Fund, Mr. Augustus Lowell sending word that he would make an annual donation of fifteen hundred dollars. Mr. Lowell allowed the Natural History Society to make engagements and announce lectures one year beforehand, and also gave the use of Huntington Hall. Eighteen lectures were given that winter, under the title of the Lowell Free Lectures in The Teachers' School of Science. Eight of these lectures were on physics, by Professor Cross; five on geology, by Mr. Crosby; five on physiology, by Dr. H. P. Bowditch, of the Harvard Medical School, and all were very successful and well attended by the teachers. The Teachers' School of Science had another branch in active operation, which was courses of laboratory lessons paid for by the teachers themselves.

Through the liberality and co-operation of the Woman's Education Association the Society of Natural History was able to announce that a seaside laboratory, under the direction of Professor Hyatt and capable of accommodating a limited number of students, would be open at Annisquam, Massachusetts, from June 5th to September 15th inclusive. The purpose of this laboratory was to afford opportunities for study and observation to the development, anatomy, and habits of common types of marine animals under suitable direction and advice. It was believed that such a laboratory would meet the wants of many teachers who had attended practical lessons in The Teachers' School of Science. Twenty-two persons—ten women and twelve men (nearly double the number expected)—availed themselves of the privileges offered. The summer work, which was very successful, was due to the ability and energy of Mr. B. H. Van Vleck, who had the whole charge of the instruction and work done in the laboratory. The seaside laboratory continued to be used successfully in the same way during seven consecutive summers, and the work of the laboratory materially influenced the future science teaching in several colleges and in many public schools of this country. In 1886 Professor Hyatt called the attention of the Woman's Education Association and the society to the fact that the laboratory had reached a stage when it could claim the support of patrons of science and learning, and be placed on an independent and permanent foundation. The two associations accordingly called a meeting, made up largely of the representative teachers of biology, who decided to make an effort to establish a permanent biological laboratory and raise at least fifteen hundred dollars to carry it on for five years. The result was the foundation of the Marine Biological Laboratory, at Woods Holl, which now attracts to its general courses teachers and other students from all over the land, and also maintains a department for special research work.

WILLIAM O. CROSBY.

In 1882 agents were obtained, by correspondence and through the kindness of the Secretary of the State Board of Education, Mr. Dickinson, in forty-four towns, who distributed tickets and filled out blanks so that the benefits of The Teachers' School of Science were extended beyond the limits of Boston. In this year there were two courses, one of ten lessons, by Professor Niles, on physical geography, and five on physiology, by Dr. H. P. Bowditch. These courses began in November and continued throughout the whole year, with a decrease in attendance after the Christmas and April holidays. These lessons were followed by five on elementary chemistry, by Prof. L. M. Norton, of the Massachusetts Institute of Technology. His subjects were as follows: First Principles of Chemistry; the next, Chemistry of Air, Chemistry of Water, Chemistry of Combustion, Chemistry of Metallic Elements. There were also five on Practical Examination, with Simple Apparatus of the Physics and Chemistry of Vegetable Physiology, by Professor Goodale, which

Laboratory of the Boston Society of Natural History used by Classes of the Teachers' School of Science.

were divided as follows: (1) Vegetable Assimilation, the mode in which plants prepare food for themselves and animals; (2) The Kinds of Food Stored in Vegetable Organs, illustrations of the starches, sugars, oils, and albuminoidal matters; (3) How Food is used by Plants and Animals in a Formation of New Parts, mechanics of growth; (4) How Food is Used in Work of all Kinds by Different Organisms; (5) Adaptations of Organisms to Extremes of Heat and Light, chiefly with respect to geographical distribution. This session was concluded with a series of five lessons on Chemical Principles illustrated by Common Minerals, by Professor Crosby.

At the beginning of this season there was the usual large attendance, with teachers from thirty towns, but the number was slowly reduced. It was evident to the curator that the decline in attendance was not due to the subjects nor the mode in which they were treated, but from fatigue on the part of the teachers, and this state of affairs caused him to say in his annual report that "proper and wise forethought should long ago have given teachers a portion of every week besides the usual Saturday holiday for the pursuit of information needed for teaching new subjects." He believed that the efficiency of the individual teacher would be greatly increased by this expedient, and that the pupils would gain more than they lost by the shortening of the school hours.

At the request of the Superintendent of Schools the curator gave the following year ten lessons, which were directed mainly to the subjects put down in the course of study under the title of Elementary Science Lessons. In his course in Elementary Mineralogy, Professor Crosby followed the plan indicated by Mrs. E. H. Richards in one of the science guides—First Lessons in Minerals. The curator, for his course on Structure and Habits of Worms, Insects, and Vertebrates, used many specimens which had been tanned by a process which was then in use. Over twenty-eight thousand zoölogical specimens were given away in two years. Professor Crosby, with a class of sixty, continued the course of the previous year, giving lessons in the mineralogical laboratory of the Massachusetts Institute of Technology, and the specimens there studied were retained by the teachers.

In the winter of 1888–'89 Professor Crosby, using for his auditorium Huntington Hall, gave a course of ten lessons on the geology of Boston and vicinity. "The object of the lessons was to acquaint the teachers of Boston and vicinity with natural opportunities by which they are surrounded, and specially to show them how to use these opoprtunities for their own culture and the benefit of their pupils. The subject was treated in accordance with the following scheme: (1) A general study of the physical features of the Boston basin and of the geological changes now in progress in this region; (2) a systematic study of the various minerals and rocks found in the Boston basin, together with the more characteristic kinds of structure which they exhibit; (3) a summary of the geological history of the district so far as that is plainly recorded in the rocks. The course was freely illustrated by maps and diagrams, also to a large extent by specimens, more than ten thousand of which were distributed. Special pains were taken at every step of the work to indicate the localities where phenomena such as were described in the lessons might be most advantageously studied. This comprehensive course formed suitable preparation for a second series of lessons, the principal object of which was to apply the principles taught by the first series to a thorough and detailed study of the physical history of the Boston basin. Each important locality in the section under consideration formed the subject of a separate lesson, in which its structural features and the more important events of its history were presented. Special attention was given to tracing the relations of the existing surface features of each district to its geological structure, thus connecting the physical geography and geology of the region. These lectures were based on a large amount of original investigation and results reached by Professor Crosby in his studies of the Boston basin."

During the winter of 1886–'87 Prof. W. M. Davis delivered a course on Problems in Physical Geographic Classification, treated of in two lessons, and the Laws of the Evolution of the Principal Topographical Types occupied the remainder of the course. Professor Davis gave the class the benefit of the results of his investigations, which were original contributions of importance to the progress of physical geography. "The graphic manner of illustrating the lessons upon the Glacial period and the effects of the great glacier upon the area of the Great Lakes was very effective. This was shown by means of a relief model whose surface was composed of an ingenious arrangement of overlying and differently painted surfaces. By removing these in succession the lecturer traced the whole history of changes following upon the recession of a continental glacier and its effects upon the surface waters. . . . These lessons were so novel and useful to teachers that he was invited to give a course of ten lessons during the next winter upon the physical geography of the United States. New matter, new models, and more extended illustrations were used in this course. The objects of the course were: To illustrate the value of systematic classification in the study of physical geography in order that forms of similar origin might be grouped together; to advocate the importance of studying the evolution of geographic forms in time, so that forms similar in origin but dissimilar in age

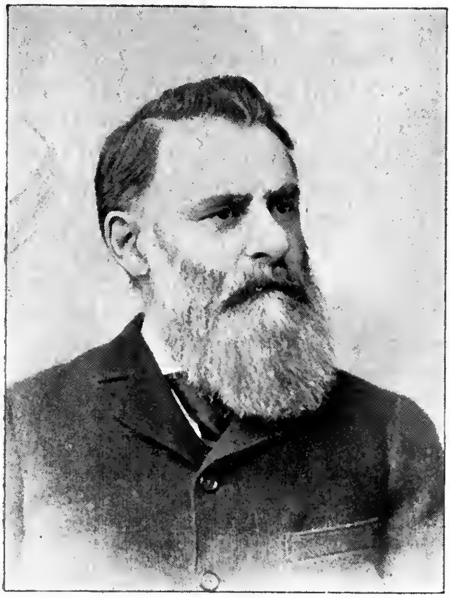
William H. Niles.

(and consequently in degree of development) might be regarded as their natural relations; to apply these principles to the physical geography of our own land; and, finally, to promote the use of models in geographic teaching. The different parts of the country were considered in this order: The mountains as constituting the framework of the continent, the plains and plateaus flanking the mountains, the rivers carrying the waste of the land into the ocean, the lakes temporarily interrupting the transportation of waste to the ocean and retarding the action of the rivers, the shore line where the land dips under the sea."

Persons interested in the improvement of the teaching of geography in the public schools suggested to the trustee of the Lowell Institute the advisability of hearing again from Professor Davis, and the curator was requested to invite him to give a course of eight lectures on geography in the autumn and winter of 1897–'98. The subjects treated of in these lessons were selected from among those presented by Professor Davis in his course on geography in the Harvard Summer School, as they afforded material most directly applicable to the work of grammar-school teachers. At the end of each meeting opportunity was given for individual conference on questions suggested by the lectures. This course excited more interest among teachers than any which had been given since the beginning of the school, and it was consequently a serious disappointment to many teachers when it became known that Mr. Lowell did not feel able to re-engage Professor Davis and continue this kind of instruction.

The same winter that Professor Davis gave his first course on physical geography Prof. F. W. Putnam, of Harvard University, Curator of Peabody Museum of American Archæology and Anthropology at Cambridge, and now President of the American Association for the Advancement of Science, gave lessons on American archæology. The topics selected covered the whole range of the remains of prehistoric man and his life on this continent so far as these subjects could be presented in ten lessons. The original methods of research elaborated by Professor Putnam, which have placed his name among the first in his department of archæological work, rendered this course remarkably interesting and instructive. Specimens were studied and given away in sufficient numbers to illustrate the modes of making stone implements and some of the different kinds of pottery. Professor Putnam invited the teachers to visit the Peabody Museum, and there gave them an opportunity to inspect the larger objects which it had not been possible to bring into the city. The audience became so interested in the famous serpent mound in Ohio, which was then threatened with destruction, that a subscription was started which finally made it possible to purchase and preserve this ancient monument.

The winter succeeding the lessons on archæology, Mr. B. H. Van Vleck, who had spent a considerable portion of the previous summer in preparing specimens for this work, gave fifteen lessons on zoölogy. The study of the general morphology of animals was made under advantages such as had never before been offered in this school, and enabled teachers to see and study structures not usually within their reach. The work was mainly directed to the observation and study of a limited number of types, but general points in physiology and anatomy were also taken up in a comparative way. The microscope was also used in this work. This special course was continued during the next two terms.


F. W. Putnam.

Dr. J. Walter Fewkes gave a series of ten lessons, during the winter of 1890–'91, on Common Marine Animals from Massachusetts Bay. Special attention was given to the mode of life, differences in external forms, local distribution, habitats, methods and proper times to collect the eggs, young, and adults. The anatomy, embryology, and morphology of the species considered were dealt with incidentally.

"The relative abundance of species and individuals, local causes which influenced distribution, the rocky or sandy nature of the shores and their characteristic faunæ, and the influence of depth of water tides and temperature, were also considered."

The relations and boundaries of the marine fauna of New England were treated of under the following heads: Comparison of the Fauna of Massachusetts Bay with that of Narragansett Bay and the Bay of Fundy, and Causes of the Differences Observed; Pelagic Animals; Littoral and Shallow-Water Genera; Introduced and Indigenous Marine Animals; and Marine Animals which inhabit both Brackish and Fresh Water.

It having been found that for several years the audiences at the general courses had been decreasing, it became evident that the giving of general information had accomplished a mission, but that there was a demand for more specialized courses of study and that a change of policy was warranted. It was therefore determined to abandon the general courses and continue the special prolonged laboratory courses.

Since 1891 all lessons have been given either in the form of laboratory lessons or field work, and the school was organized and conducted upon a new and more effective basis. The teachers have been required to keep notebooks and attend examinations in order to be candidates for the certificates which have been, and will continue to be, granted to those who have completed a series of lessons.

In the fall of 1890 was begun a course of lessons on paleontology which had been planned for some time but had not been previously undertaken because the teachers lacked the knowledge of the elements of zoölogy and geology which was a necessary preparation for those taking up the study of the history of animals as found in the earth's crust. The members of this class, which now began to make systematic observations upon fossils, were found to be sufficiently prepared to study certain groups which illustrated the laws of evolution. The class was limited in number and was under the instruction of Professor Hyatt, who for five years conducted the most advanced course of lessons ever given in The Teachers' School of Science, and such as have not elsewhere been offered to teachers nor to many classes of college students.

The lessons began with general instruction in the use of the microscope, the structure of cells and their union and differentiation into tissues, and then a study of simplest organisms—*Protozoa.* The work was continued through *Porifera*, *Hydrozoa*, and *Actinozoa*, and the types of fossils compared with their living representatives. The periods of occurrence of fossilized remains in the rocks were noted, and the characteristics of the different periods mentioned, but details of stratigraphic character were subordinated to the tracing out of the relations of the animals and the laws which governed the evolution of their forms. Special attention was given to those classes whose history is most complete and which furnish the best specimens for examination.

Echinodermata, represented by a large number of both living and fossil forms, was made the subject of study the second winter. The common starfish was examined in detail, and with it were compared other members of its class—*Asteroidea*, living and fossil forms in *Ophiuridea* and *Echinoidea*, the modern *Holothuroidea*, the ancient *Blastoids* and *Cystoids*, and both extinct and modern *Crinoids*, the last of which were illustrated by alcohol specimens of

Comatula. Professor Hyatt was assisted in giving these lessons by Miss J. M. Arms, who, in conjunction with him, had previously written the largest of the Science Guides—entitled Insecta—and by Dr. Robert T. Jackson, who has done much work on this group of fossils. One member of the class a few years ago, after receiving these lessons, looked over and prepared a large number of fossils, principally *Crinoids*, belonging to the Natural History Society, and discovered a form of paleozoic *Echinoderm*, which proved to be an interesting new species and was described by Dr. Jackson as *Lepidesthes Wortheni*.

The third year of this series consisted of lessons on *Brachiopoda* exclusively. Professor Hyatt was at that time in correspondence with Dr. C. E. Beecher, of Yale, the distinguished paleontologist, who has made remarkable discoveries and was then investigating *Brachiopoda*, and communications from him regarding this group were from time to time read to the class. "The sudden expansion or the quick evolution in the earlier periods of the earth's history and the slower evolution of the same types in their progressive history, after a period of sudden expansion had been passed through," were shown in several series.

J. Walter Fewkes.

The ancestral form of this group, the phylembryo, has been found in *Paterina*, whose adult represents the youngest stage, the beak of the shell, of other *Brachiopods*. There was, therefore, unusual opportunity to here illustrate theories of evolution, particularly the theory of constitutional tendency involving a conception of the youth, maturity, and senescence of species. In order to make the instruction clearer, terms used for the different stages of development by Professor Hyatt in his writings on bioplastology were explained to and used by the class.

The many specimens used in this study were carefully figured in the notebooks, and the teachers became so familiar with them that they were able to pass at the end of the term a severe examination. The final test of the season's work consisted of three parts: The passing in of lecture notebooks, the naming and classifying of a dozen fossils selected by the professor, and the answering of a set of difficult questions.

On account of the amount of time required for this course, and because the lessons were such as were not directly applicable to work in the public schools, the attendance decreased. The number who continued, however, were those who felt that a broad scientific education is necessary to the best teaching of even elementary science.

The fourth year was devoted to *Mollusca*, *Cephalopoda* in particular, and the class was fortunate in having for its teacher one whose investigations in this latter group have given him world-wide fame.

The evolution of the group from its straight radical form, now named and called *Diphragnoceros*, was traced through the bent, curved, and coiled forms of the *Nautiloids*, *Ammonoids*, and *Belamites*. The phylogeny of the *Ammonoids* presented a complete cycle, late forms entirely uncoiling and presenting the straight characters of their ancestors.

The study of *Cephalopods* amply illustrated the neo-Lamarckian theory of evolution, including the inheritance of acquired characters which is now believed by most paleontologists.

The fifth and last year of this course included the study of *Arthropoda* and *Vertebrata*. The insects presented many illustrations for the theory of natural selection, which the neo-Lamarckians consider an aid, but a subordinate factor, in the origin of species.

About this time Poulton gave a series of twelve lectures on animal coloration at the Lowell Institute, drawing his illustrations mainly from insects. Many of the students of The Teachers' School of Science in zoölogy and paleontology attended these lectures.

After working on fishes, batrachians, reptiles, birds, and mammals, in which the structural development of some animals—man, for example—was found to be retrogressive and the physiological development progressive, the lessons closed with the study of man's structure as compared with the anthropoid apes and the few remains of prehistoric man, and finally with a discussion of the works of paleolithic man.

The teachers who had attended this course throughout the five years and had passed satisfactory examinations have been presented with diplomas testifying to their proficiency.

[*To be continued.*]

PROPER OBJECTS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

By EDWARD ORTON,
PROFESSOR OF GEOLOGY IN OHIO STATE UNIVERSITY;
PRESIDENT-ELECT OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE objects of the American Association for the Advancement of Science are clearly expressed in the opening paragraph of its constitution, which was adopted at its first meeting, held September 20, 1848, in Philadelphia. From that day to this the paragraph referred to has not been modified except by the replacement of three words, viz., "the United States" by a single and more comprehensive word—"America."

As here defined, the objects of the association are "to promote intercourse between those who are cultivating science in different parts of America, to give a stronger and more general impulse and a more systematic direction to scientific research in our country, and to procure for the labors of scientific men increased facilities and a wider usefulness."

Three distinct elements are included in this general statement, viz.: (1) The cultivation of personal intercourse or acquaintance among the workers in science in this country; (2) the encouragement, extension, and proper direction of scientific research; (3) the gaining of popular recognition and good will for the results of scientific work. These objects may be conveniently summarized as (1) *social*, (2) *scientific*, (3) *practical*.

There is nothing in the original paragraph to indicate whether the elements of this threefold division were counted of equal value, or whether they were arranged in either an ascending or descending scale of importance, but from the fact that in the development and expansion of the association during the last fifty years nothing has been added to and nothing subtracted from this general statement, while in many other divisions of the constitution large and sometimes radical changes have been adopted, it seems safe to conclude that the present members of the association see its work and office in very much the same light as its founders did.

But, while sailing under the old colors and apparently by the old charts, it is quite possible that the association is, insensibly to itself, undergoing modification more or less important. Such an experience is unavoidable in all human institutions, at least in those that retain their vitality in state, society, or church.

The fifty years that cover the life of the association are unquestionably the most important, so far as the growth of science is concerned, in the history of the race. Within this period every science has been recast and rewritten, and divisions and subdivisions of the old units have gone forward and are still in progress. Of every one of these sciences the boundaries have been so enormously extended that even the *dream* of universal knowledge on the part of any man has gone by, never to return. Leibnitz, it has been said, was the last of the intellectual giants of old who mastered all that was knowable in his day. Alexander von Humboldt could almost claim the same for the knowledge of Nature that was attainable in the first quarter of our century. But since the application of the compound microscope to the study of Nature and the subdivisions of the sciences that have resulted therefrom, and especially since the extension of the method of science to all the branches of anthropology, as language, history, institutions, the task of mastering all that is known is seen to be altogether too great for finite powers and span-long lives.

It might well be, therefore, in view of the amazing changes that have taken place in the entire field covered by the association, that it should have outgrown the aims and ambitions of its early days. The fact that it continues to use the identical statement of its objects with which it began its work, while it does not definitely settle the question, affords at least presumptive evidence that no such change has taken place.

How, then, do the objects originally recognized by the association as its *raison d'être* correspond to the needs of our own time?

1. Is the *social* feature of the association, to which the first place was assigned by the founders, whether by design or not, worthy of preservation by us? In other words, is it as important "to promote intercourse between those who are cultivating science in America" at the close of the nineteenth century as it was at the middle of the century—the need that was responded to by the formation of the American Association for the Advancement of Science? While revolutionary changes have taken place in the country at large during this period in modes of travel, facilities for acquiring education, and the diffusion of intelligence, it would be hard to show why the need in this field should be in any respect less urgent. There is a far larger number of people who are cultivating science, and there are many more branches of science to be cultivated.

What particular service is to be expected from such intercourse as the association seeks to provide? The gathering of the workers in the diverse fields of science into a single organization has a tendency to *unify* them. They find that a common spirit animates them, that they all make use of essentially the same method of research or inquiry, and that the results which they reach all have a common note of certainty, being herewith differentiated from other and older views on the same subjects, as knowledge differs from opinion. They are thus led to see more clearly than they could otherwise see the unity of the universe, that knowledge is one, and that each science is but a facet cut on the crystal sphere of natural truth, touching other facets at many points, and by no means independent, but supported by the integrity of the sphere.

Such a gathering tends to an increase of mutual respect and confidence on the part of all engaged in scientific work. It tends to discourage the narrow conceit of the specialist, who, if left entirely to his own tastes, comes to think that his own facet is the only one that deserves to be regarded, and practically to ignore its relation to the sphere of which it constitutes an essential though a minor part.

Such an association tends toward making specialists intelligible to each other. In other words, it puts a premium on the art of popularizing science, for when the specialist makes himself intelligible to his brethren in their widely separated fields he makes himself intelligible to all educated men, whether especially trained in science or not.

The specialist is under a strong temptation to limit himself to a language of his own, which is an unknown tongue even to the rest of the scientific world. Technical terms, carried out to minute subdivisions, are indispensable in every branch of modern science, but the student of any science is in an evil state who can not present his results to the world without appealing to the technical jargon of the branch which he cultivates.

There even seems a reluctance on the part of some to use plain language in stating scientific conclusions, as if the cheapening of science were feared by its being made intelligible. Such a fear is certainly unworthy. The masters have never felt it. In lucidity and directness of speech and in general intelligibility Tyndall, Huxley, and Darwin were not surpassed by any men of their generation. To whom are we as much indebted for the great advance of science in their day as to these very men?

If the scientist neglects this popularizing of science, the sciolist is sure to take it up, and his work in this field always makes the judicious grieve. Is there not possible danger that this phase of scientific work and the function of the association corresponding thereto are losing consideration to some extent?

But instead of its being true that the scientific work of the country has outgrown the need of the association, is it not rather true that we are in far more urgent need of its unifying agency than even the founders were fifty years ago? We have all the divisions of science that were then recognized, and half as many more. Physics and chemistry could then be classed in one section without offense, and zoölogy and botany were assigned without protest to a single heading. Now, not only does every science demand recognition by and of itself, but all are represented by separate societies as well—as the Mathematical Society, the Chemical Society, the Geological Society, etc. These societies hold meetings, publish bulletins, reports, and sometimes monthly journals, and, in short, aim to cover the entire field for the branches which they represent. They are generally affiliated with the association, and it is becoming usual for them to hold joint summer meetings of society and section. Their annual meetings are held in the winter, and, as their membership is more select than that of the association, standing as it does in all cases for published or recognized work already in evidence, these winter meetings are coming to be preferred for the presentation of technical papers. Those who read them feel sure of "fit audience, though few."

These societies are all vigorous and successful. They obviously meet a "felt want" on the part of American science, but just what their effect will be upon the association remains to be determined. Certainly, with these centrifugal tendencies in growing activity, this is not the time for the attraction of our one centripetal force to be relaxed. More than ever do we need such a unifying agency as the association was designed to supply.

Some *modus vivendi* between section and society will doubtless be found. Perhaps the more abstract and technical papers will be reserved for the winter meetings, while those dealing with the larger phases, and especially those pertaining to the philosophy of the subjects discussed, will find their places in the joint meetings of the summer.

It would be well if the association meetings of whatever character could be made memorable by the announcement of important discoveries made during the preceding year. The custom of holding back such announcements is said to obtain in the transatlantic national associations, and notably in the British Association, which is the mother of all the rest. Those who were present at the Boston meeting of the American Association will remember the enthusiasm created there by the announcement of the discovery of a new element—etherion. If later discussions have thrown doubt upon the discovery of a new element, the alternative explanation suggested of the facts proves scarcely less interesting or important than the original claim.

Whether our eager American workers would be willing to hazard their claims to priority by holding back the announcements of their discoveries for months after they have been made is a question, but the foreign practice in this regard has certainly much to commend it.

It would be a calamity of real magnitude to American science if the sectional meetings of the association were abandoned to men who have not done enough approved work to entitle them to places in the several societies already named. The old title—The American Association for the Advancement of Science—might still be retained, it is true, but what a humiliating misnomer it would be if none of the men who *have* advanced science in the past by their labors and none of those who are prepared to advance it in the future by their training were now included! It would be the omission of the part of Hamlet from the play.

The foremost men in all the societies, our leaders in the branches represented there, owe it to themselves, owe it much more to the great name of American science, to maintain and magnify their connection with, their service to, the American Association.

At the second meeting of the association it was the illustrious Joseph Henry who called the attention of his brethren to the fact that the organization was, by its very name, consecrated to the *advancement* of science—to the discovery of new truth. He reminded them that the association was not designed to furnish opportunity for the restatement of what was already known. Its purpose was rather to add to the existing body of knowledge in the world. Let not the hopes of the founders be brought to naught by allowing the organization from which they expected so much to be thus eviscerated!

We see, then, that the *social feature*, with what it legitimately includes, deserves to hold as prominent a place among the objects of the association at the end of the century as was given to it by its founders when first established.

Two other objects which were deemed worthy of being incorporated into the organic law of the association remain to be considered. To the treatment of each a few words will be devoted. Neither of them commands as high regard from us as they seem to have had at the beginning.

2. The second object of the association as declared by the founders was "to give a stronger and more general impulse and a more systematic direction to scientific research in our country."

It is not easy for those who were born after the middle point of the century to think themselves back into the conditions under which the words above quoted were written. At that time there were but two or three schools of science in the United States, and not one west of the seaboard. The degrees of bachelor, master, and doctor of science were unknown. There was but one journal of science published in the country, and foreign scientific journals and reviews, comparatively weak and few at the best, seldom found their way to the New World. The men who cultivated science were widely separated, and for the most part rarely met their peers. As a natural consequence, there must have been more or less misdirected effort. Many a worker must have attacked problems already solved, or have attacked them by inadequate or obsolete methods.

How great the changes that fifty years have wrought in this country, in the world indeed, in all these respects! Now there is not a State in the Union that has not at least one fairly equipped school of science, and in some of the older States such schools can be counted by the dozen or the score. These schools are manned by teachers trained at the foremost centers of science in this country and Europe, familiar with all the great problems and with all the most improved methods of research. Moreover, on the library table of every one of these schools are the latest periodicals and special reports of the two continents in which science is cultivated. The untrained and isolated investigator can no longer justify his existence. There is no occasion for the survival of such qualities as these terms imply.

This wonderful transformation in educational scope and methods effects to a great degree just what the founders hoped to accomplish through the agency of the association. The ground has thus been cut from under the second of the objects of the association as avowed in its constitution. In other words, while the result aimed at deserved the prominence given to it fifty years ago, it no longer depends on the association for its accomplishment.

3. The third of the objects which the association was organized to accomplish was "to procure for the labors of scientific men increased facilities and a wider usefulness." This clause evidently refers to the endowment of science by founding and equipping institutions, professorships, laboratories, museums, and the like, and to a more cordial and general appreciation of the results of scientific work.

In this direction, also, such immense progress has been made in the country at large that the need of special effort in this line no longer exists. Munificent gifts to science from private fortunes are now the order of the day. It is a poor year for science in America when such contributions do not exceed a million dollars. This work was begun in the large way under the elder Agassiz, and the Museum of Comparative Zoölogy at Cambridge is its first important monument. It has gone forward in the addition of scientific departments worthy of the name to the older institutions of learning, and in the establishment of new institutions wholly devoted to science.

Such beneficent use of private wealth, the unparalleled increase of which during the last fifty years has become a matter of grave concern to the whole body politic, does more than anything else can do to reconcile the public to the conditions which make such accumulations possible. Still more significant is the policy which the General Government entered upon, forty years ago, of establishing, in conjunction with the several States, schools of general and applied science. The State colleges and universities thus founded have already become potent factors in American education, and science lies at the heart of them all. It would be hard to overrate their influence on the development of science for time to come.

When the American Association was established, fifty years ago, a new day was breaking on the world. The men who were cultivating science then saw something of the conquests over Nature that the new method—the method of science—rendered possible. They were wise in demanding that all who use this method should recognize the common bond. The association was the outcome of that demand.

At the end of the century we who have shared in the mighty advance and who have been taught by our experience to discard limitations in the possibilities of the future, feel the same and an even more urgent need of some unifying and interpreting agency for the ever-widening fields to which the method of science is now applied.

RACE QUESTIONS IN THE PHILIPPINE ISLANDS.

By FERDINAND BLUMENTRITTE.

WHEN I published my article on the History of Separatism in the Spanish colonies, in the *Deutsche Rundschau* for July, 1898, I said that the colored peoples of a colony would always be inclined to struggle for the independence of their native country, because the rule of the mother country of the colony makes their access to the highest positions in the state impossible. I declared, further, that in the Philippine Islands the contempt manifested toward the colored tribes by the Spanish press had contributed very much toward making the gulf between rulers and ruled progressively deeper and harder to bridge. The natural conceit and sensitiveness of the colored races in America could never weigh as heavy in the scale as those of the colored Filipinos do, because in America the creoles and their numerously represented crosses were the real upholders of separatist ideas, so that when the idea ripened into an act they held the leading of the movement in their hands. Indians and negroes have there never been more than the *plebs contribuens*, or the tributary class, and "food for cannon." Only in single exceptional cases have leading spirits ever risen from out of these lower castes; and where the separatist movement has been confined to these colored primitive races, as in Haiti, it has led not only to cutting loose from the mother country, but also to a more or less complete renunciation of European civilization. In saying this I cast no condemnation upon the negroes, for, whenever in our civilized states the proletariat and the populace have struck down or cast out all the cultivated and half-cultivated classes, the same sort of "nigger management," with only differences corresponding with the environments, has gained place among us as in the great islands of the Antilles.

Very different are the conditions in the Philippine Islands; and, in view of the importance which the "skin question" plays in the conflict raged by the Americans, I think it proper to deal further with this fundamental question of Philippine politics, especially since the journals and the politicians, at least those of America, have given very little attention to the matter.

The small number of creoles, of whom, besides, the principal part live in the city of Manila, which the Americans have in their power, would not alone explain why the war of independence and the formation of the Philippine republic must be spoken of as preeminently the work of Christian, civilized Malays and mestizos. For there are in America countries, like Paraguay, where the number of whites is even smaller than in the Philippine Islands, and yet the separatist movement and the foundation of the state were the exclusive work of the creoles.

Why has it been thus? Because the Indians and the negroes do not possess that inclination toward civilization and that capacity for assimilation that are evident in the colored populations of the Philippine Islands. It is supposed that the Philippine Malays have Japanese blood in their veins; but, all the same, whether the supposition is founded or unfounded, it is certain that not only do they resemble the Japanese more or less in features, but that also many mental traits are common to them with these wide-awake Orientals, and they even excel them in a moral respect. The school statistics show them superior to their Spanish lords. The Filipinos have no larger percentage of illiterates than Spain of those who can not read and write. And, as a bishop exclaimed with astonishment, there are in those islands villages where it would be hard to find a person unable to read. The pressure of the colored people to the higher studies and the special schools far exceeds the percentage which one would anticipate from their proportion to the whole population. And if we add to these those who seek their education in Spain and other foreign countries we shall find Malays and mestizos in the first line, and the creoles in the last. It should be remarked on this point that many more natives would have gone to Europe for education if the Spaniards, and especially the monks, had not perceived conspirators in all Filipinos who studied away from home. The fear of persecution deterred many fathers from sending their sons over the sea.

More than ten years ago a prominent monkish writer showed how the professions of medicine and the law were crowded with Malays and mestizos. But besides these two professions and that of the secular clergy the colored Filipinos turned also to engineering and art. With respect to art, I am not thinking of the skillful goldsmiths and silversmiths of Manila, although these artificers are among the best, but I refer to artists of divine gifts, among whom the mestizo F. Resureccion Hidalgo, resident in Paris, and Don Juan Luna, of the tribe of Ilokans of northwestern Luzon, brother of the Philippine minister Antonio Luna, are most conspicuous. Luna is not unknown to us Germans, for the Leipsic *Illustrirte Zeitung* some time ago published a wood engraving of his great prize-crowned picture Spoliarum. The best testimony to his eminence is the fact that the Spanish Senate honored this artist, who was then living in Paris, with the commission to paint for its chamber a pendant to Padilla's famous picture Boabdil Surrendering the Keys of Granada to the Catholic Queen, and he painted The Battle of Lepanto. And among the Filipino poets the name of the great Tagal, Dr. Rizal, has become known to the whole world through his skill in tragedy.

There is no need of mentioning any other names, for those we have given are enough to show that these Malays and mestizos are susceptible of cultivation, and, as Bismarck used to say, "carry a rocket-charge in their bodies." *

As the Spaniards who came to the archipelago were for the most part only monks or officers, trade, so far as it was not in the hands of foreigners, was dependent on the participation of the colored population, particularly of the mestizos. And what of large land ownership the monkish orders had not absorbed likewise belonged for the most part to the colored races. None but foreigners and colored took part in all the great enterprises of the country. The Spaniards only ruled.

This position of the colored population in the country was the

* Einen Raketensatz im Leibe führen.

more perilous to the Spaniards, because the Spanish press, particularly the monkish journals, systematically treated them with scorn, called them anthropoids, and denied their capacity to attain European civilization. The educated Filipinos foamed with rage when spoken to about these attacks upon their race. "Besides," they said, "it makes the color of our skin a stigma with the Spanish lords, and with all Europe too; why thus insult us and in so cowardly a way, when the censorship at Manila makes it impossible for us to defend ourselves?"

But all these noisy revilings of their race could only outwardly, not inwardly, disturb the self-esteem of the Malays, because their leading spirits had by critical psychological studies of the white race confirmed the opinion of the simple Tagal peasants that the whites are made out of the same earth as the colored, and that the latter could, under equal conditions, have done as well as they. Only the whites have adopted that lordly code of morals which, like the flag with contraband goods, covers the grossest breaches of right and other outrages, which a white gentleman would not venture, indeed, to commit upon his peers, but which, in the treatment of colored men, belong, so to speak, to good tone, to "European smartness."

The educated brown man generally feels in his intercourse with the European that uneasiness, that poorly concealed embarrassment, which the parvenue with us feels in the presence of one of the blue-blooded aristocracy. He feels every instant that the white man's critical eye is upon him, and knows that the criticism will be pitiless and harsh to injustice. He knows, further, that this criticism in every case does not apply only to him, the individual, but that conclusions are drawn at once from his errors, even though they may be only presumed, that are applied to his whole race or caste—conclusions which are never flattering, but always culminate, in agreement with the scorn of the superior, in a severe condemnation.

This consciousness of running the gantlet before the eyes of Europeans often causes the brown man to commit mistakes in European society, which refuses to pass him among people whose favor he would be sure to enjoy.

The opinion which Europeans living in the tropics form of the brown men is generally unfavorable and unjust to them. We Europeans, or rather our nations and states, already judge one another harshly and in a more than partisan manner, because we see first only the weaknesses, often even only the fancied weaknesses, of our neighbors. How, then, could we expect anything better when a European has to pass an opinion on a brown man? We should not forget that only those Europeans go to the tropics who display special energy and force of will—a kind of chosen lot among our race—while the natives there include all the levels of the people. If we add to this that all the Europeans believe in their own superiority and in the inferiority of the brown men, it will seem quite natural that when the Europeans begin to make comparisons between themselves and the natives the comparisons will always be flattering to those who make them.

In the Philippine Islands, on the other hand, the reaction of the natives against this extreme self-conceit of the whites has been making itself felt for more than twenty years. This has come to pass since the philosophical heads among them have carefully studied the whites in the various countries of Europe, and have in consequence lost faith in the divine likeness of the Caucasians.

Single examples of the studies of these men have been published, such as that of the war minister of the Philippine republic, Don Antonio Luna, a pure-blooded Malay like his brother the painter. Luna studied in Spain and in Paris (under Pasteur), and lived a little while in England, so that he had opportunities to become acquainted with three civilized nations at their home. His literary works are represented to us in the garb of novels and *feuilletons*, the sarcasm of which, while it certainly escapes the uninitiated European, will be all the more effective and precious upon those who are acquainted with the purpose of the brilliant author, which is to satirize the depreciatory accounts by European travelers of the land and people of the Philippine Islands. This he does by telling of his rummaging through the critics' home and finding all the weaknesses and faults which are accredited to the brown men as signs of their incapacity no less prevalent in Europe than in the Philippine archipelago; and arguing that therefore the whites and the browns differ only in the color of their skin, in build, and in language, but not in mind.

If space allowed I should be glad to follow my inclination to repeat some of Luna's descriptions, which are given in a style that reminds one of Maupassant's. I shall only say that Luna has drawn within the circle of his observations the movements of all classes in the aristocratic saloon and in the workman's beerhouse, and remarks that everything that has been charged against the brown man appears likewise in the European. The first sketch is excellent. European travelers speak in their works of the "stupid staring" at their white-skinned, thoughtful faces by the "brown savages." Luna, whose pen-name is Taga-ilog,* parodies these stories by simply relating that on his arrival in Europe and during his

* From over the water; or it may be derived from Ilokos, or Tagal.

earlier residence there the people on the streets stared at him, and some of the boys threw stones or stuck out their tongues at him. He did not, however, care for that, while he expected that the better circles would convince him of the superiority and the innate tact of the lordly race by their more refined behavior. But it did not turn out so. He saw the ladies in the saloons tittering behind their fans and making merry over "the queer man." And then at the table! How plain was the expression of astonishment among the gentlemen of the saloons that the brown man behaved in his eating just as the whites did! They had apparently anticipated that the "black" would act as if he were tearing live pigeons to pieces and swallowing them. The indolence of the Europeans is shown up no less amusingly. Luna finds it apparent in all conditions, prevailing in the highest and the lowest social strata. He asks what would become of the industry and activity of the European peoples if they were suddenly given the climate and the fruitfulness of his native land. These two examples are all we can give. Likewise interesting are the studies of my Tagalog friends Don Marcelo H. del Pilar and Don Mariano Ponce. The former, an advocate from the province of Bulakan, in the island of Luzon, and a descendant of King Lakandola, of Manila, was the leader of the Reformist party and the chief editor of the journal *La Solidaridad*, published in Madrid, which he directed with a remarkable skill that was recognized by his opponents. He died in Barcelona in the summer of 1896. His compeer, Ponce, is now living in Japan and is no less distinguished than Pilar for his keen wit and his zeal in research.

These two Malay jurists carefully examined the criminal records of Europe. Why? Because, whenever an extraordinary or especially heinous crime was committed in the Philippine Islands, the Spaniards were accustomed to use it to confirm their conclusions as to the innate inferiority of the Malay race. "That could occur only among a people of inferior intelligence," was their standing phrase. Del Pilar and Ponce gathered the accounts of trials from the European journals, and were able to reply to the Spaniards quietly: "No, that is not so. All these crimes occur among you Europeans, and relatively more frequently than with us. Your conclusion is therefore false, or else you too have a defective intelligence such as you ascribe to us." Del Pilar, from his studies of the colonial enterprises of all peoples, came to the conclusion that "the Europeans founded most of their colonies at a time when the holding in vassalage of men of their own race by whites and the slavery of negroes and Indians were not regarded as offenses. If, now, we look at colonies in which, as in the Philippine Islands, agricultural populations are living with a civilization of their own, the development of the native races will depend on their religion. In a colony where Islam or a dogmatized heathen religion prevails no assimilation between Europeans and natives can take place. It is otherwise in countries like the Philippines, where the natives accepted Christianity at a time when religion had more importance among Europeans than now; a common basis was formed for the co-operation of both parts, the whites and the colored. But the circumstance that rulers and ruled had the same religion and the same official language may have led directly to another evil—that the colors became marks of condition, the whites being the Spartans, the mestizos the perioikoi, and the colored men the helots or servile people. So long as no pressure toward higher ambitions occurred from among those of the perioikoi and the helot grades, and so long as the whites were able to keep their prestige freely recognized by their dependents, the view of the whites, that the colored were both socially and intellectually a lower caste, seemed to be justified. The case has been different in the present century, especially in the second half of it. People of our (Philippine) race attended the high schools, appropriated to themselves the civilization and the knowledge of the whites, and still the brand of inferiority stuck to them. And this happened, too, when the quality of the whites had deteriorated. They were no longer exclusively *señors*, but there came bankrupted Spaniards or those of the lowest classes into the country, among them persons who could not read and write, who should be rated as beneath our school-trained people. And yet these illiterates claimed, by virtue of their color, to be respected as lords of the land, an absurdity which left the idea of 'European prestige' without justification, for how could beggars, spongers, bummers, rowdies, and illiterates impress anybody? The decent Spaniards committed the mistake of avowing their solidarity with the sorry fellows of their caste, instead of rejecting them and holding aloof from them and sending them back to Spain. So the Spaniards have brought it to pass, through a mistaken policy, that the Filipinos on their side, too, throw the good elements of the Spanish population into the same pot with the foul. Another reason why a Spanish prestige can not be thought of among us is that, with the exception of the tobacco companies, all the great enterprises in our country are carried on by foreigners and Filipinos. We owe all that is called progress not to the Spaniards, but to our own force or to foreigners."

When the painter Juan Luna attracted so much attention with his picture Spoliarum it was not known that the artist was a Malay, and the work was therefore regarded and criticised from a purely artistic point of view. But as soon as the race of the painter became known, European prejudice made itself manifest. It was said that the choice of a tragic subject could unquestionably be traced back to the descent of the artist from "savages." But when did artists of the white race ever shrink from such subjects? Luna has had cause enough to complain of European injustice. The natives are charged with not being independent in art. "They can only imitate," it is said. But how many European nations one would have to strike out of the list of the civilized if that title is to belong only to those which have an art of their own! It should not be forgotten that the Spaniards have, during their three hundred years' rule, impressed a Spanish mark on the native artistic tendencies. The ethnographer who is acquainted with the woven and carved designs of the heathen tribes which have remained free from the Spaniards and from Christian civilization will certainly not be able to deny that the Malays of the Philippine Islands have a great talent for ornamental art. But if the reproach is cast against the Filipinos that they have tried to Europeanize themselves in plastic art as well as in music, they have not done differently from the Europeans—that is, they denationalize themselves and come into the great international circle of civilization, a thing that can hardly be charged as a sin against them. It is very remarkable, they say, that Europeans condemn in the Filipinos, as a mark of inferiority that which they regard in themselves as a sign of progress.

Rizal also has spoken of the injustice of the judgments which Europeans pass upon Philippine conditions. I have published his views on this subject in the tenth volume of the *Internationalen Archivs für Ethnographie*, and will therefore on the present occasion only give a sketch of them, with a few additional observations to complement them. Dr. Rizal says that most Europeans judge the natives from their servants, which would be as false as if anybody should form his conception of the German people from the complaints which German housewives are always ready to make concerning their domestics. At one time while he was visiting me we strolled out of town. He gathered some wild flowers and asked me their names. I had to confess respecting many of them that I knew neither their common nor their botanical names. He laughed and said: "Well, you are a cit; let us ask a countryman." We met a peasant, but he could not give us any information about any of the flowers. "Why," Rizal said, "is this the first time you ever saw the flowers?" The peasant replied that he knew the flowers very well, but did not know what they were called. When the countryman had gone, Rizal said to me: "How fortunate you Europeans are as compared with us poor Tagals! If such an experience as I have just gone through should happen to a European among us he would write in his notebook that 'the stupidity of these people shows itself in the fact that they do not know or have no names for many of the flowers which they see every day and tread upon with their clumsy feet. What can not be eaten or put to some immediate use has very little value or interest to these fellows, and such dull-witted folk as these want reform and autonomy!' And he would be only a modest traveler. Another one would write a whole chapter over the incident, as illustrating the inferiority of all our people."

I might continue at greater length on this theme, but I believe that the reader will sufficiently apprehend from what I have said that the European and American whites have not made a good impression on the colored Filipinos, and that the Philippine creoles feel as one with their colored brethren; that there is no spirit of caste in the matter like that which existed in the old colonial times, but they all call themselves simply Filipinos, and that the rule of the American Anglo-Saxons, who regard even the creoles as a kind of "niggers," would be looked upon by educated Filipinos of all castes as a supreme loss of civic rights.—*Translated for the Popular Science Monthly from the Deutsche Rundschau.*

DO ANIMALS REASON?

By EDWARD THORNDIKE, Ph. D.

PROBABLY every reader who owns a dog or cat has already answered the question which forms our title, and the chance is ten to one that he has answered, "Yes." In spite of the declarations of the psychologists from Descartes to Lloyd Morgan, the man who likes his dog and the woman who pets a cat persist in the belief that their pets carry on thinking processes similar, at least in kind, to our own. And if one has nothing more to say for the opposite view than the stock arguments of the psychologists, he will make few converts. A series of experiments carried on for two years have, I hope, given me some things more to say—some things which may interest the believer in reason in animals, even if they do not convert him.

In trying to find out what sort of thinking animals were capable of I adopted a novel but very simple method. Dogs and cats were shut up, when hungry, in inclosures from which they could escape by performing some simple act, such as pulling a wire loop, stepping on a platform or lever, clawing down a string stretched across the inclosure, turning a wooden button, etc. In each case the act set in play some simple mechanism which opened the door. A piece of fish or meat outside the inclosure furnished the motive for their attempts to escape. The inclosures for the cats were wooden boxes, in shape and appearance like the one pictured in Fig. 1, and were about 20 × 15 × 12 inches in size. The boxes for the dogs (who were rather small, weighing on the average about thirty pounds) were about 40 × 22 × 22. By means of such experiments we put animals in situations seeming almost sure to call forth any reasoning powers they possess. On the days when the experiments were taking place they were practically utterly hungry, and so had the best reasons for making every effort to escape. As a fact, their conduct when shut up in these boxes showed the utmost eagerness to get out and get at the much-needed food. Moreover, the actions required and the thinking involved are such as the stories told about intelligent animals credit them with, and, on the other hand, are not far removed from the acts and feelings required in the ordinary course of animal life. It would be foolish to deny reason to an animal because he failed to do something (e. g., a mathematical computation) which in the nature of his life he would never be likely to think about, or which his bones and muscles were not fitted to perform, or which, even by those who credit him with reason, he is never supposed to do. So the experiments were arranged with a view of giving reasoning every chance to display itself if it existed.

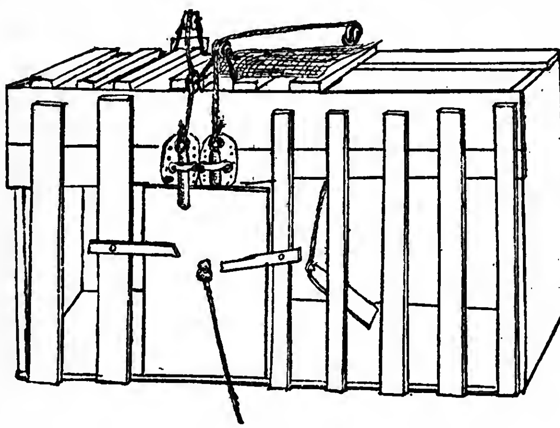


Fig. 1.

What, now, would we expect to observe if a *reasoning* animal, who is surely eager to get out, is put, for example, into a box with a door arranged so as to fall open when a wooden button holding it at the top (on the inside) is turned from its vertical to a horizontal position? We should expect that he would first try to claw the whole box apart or to crawl out between the bars. He would soon realize the futility of this and stop to consider. He might then think of the button as being the vital point, or of having seen doors open when buttons were turned. He might then poke or claw it around. If after he had eaten the bit of fish outside he was immediately put in the box again he ought to remember what he had done before, and at once attack the button, and so ever after. It might very well be that he would not, when in the box for the first time, be able to reason out the way to escape. But suppose that, in clawing, biting, trying to crawl through holes, etc., he happened to turn the button and so escape. He ought, then, if at once put in again, this time to perform deliberately the act which he had in the first trial hit upon accidentally. This one would expect to see if the animal *did* reason. What do we really see?

To save time we may confine ourselves to a description of the twelve cats experimented with, adding now that the dogs presented no difference in behavior which would modify our conclusions. The behavior of all but No. 11 and No. 13 was practically the same. When put into the box the cat would show evident signs of discomfort and of an impulse to escape from confinement. It tries to squeeze through any opening; it claws and bites at the bars; it thrusts its paws out through any opening, and claws at everything it reaches; it continues its efforts when it strikes anything loose and shaky; it may claw at things in the box. The vigor with which it struggles is extraordinary. For eight or ten minutes it will claw and bite and squeeze incessantly. With No. 13, an old cat, and No. 11, an uncommonly sluggish cat, the behavior was different. They did not struggle vigorously or continually. (In the experiments it was found that these two would stay quietly in the box for hours, and I therefore let them out myself a few times, so that they might associate the fact of being outside with the fact of eating, and so desire to escape. When this was done, they tried to get out like the rest.) In all cases the instinctive struggle is likely to succeed in leading the cat accidentally to turn the button and so escape, for the cat claws and bites all over the box. These general clawings, bitings, and squeezings are of course instinctive, not premeditated. The cats will do the same if in a box with absolutely no chance for escape, or in a basket without even an opening—will do them, that is, when they are the foolishest things to do. The cats do these acts for just the same reason that they suck when young, propagate when older, or eat meat when they smell it.

Each of the twelve cats was tried in a number of different boxes, and in no case did I see anything that even looked like thoughtful contemplation of the situation or deliberation over possible ways of winning freedom. Furthermore, in every case any cat who had thus accidentally hit upon the proper act was, after he had eaten the bit of fish outside, immediately put back into the box. Did he then think of how he had got out before, and at once or after a time of thinking repeat the act? By no means. He bursts out into the same instinctive activities as before, and may even fail this time to get out at all, or until a much *longer* period of miscellaneous scrabbling at last happens to include the particular clawing or poking which works the mechanism. If one repeats the process, keeps putting the cat back into the box after each success, the amount of the useless action gradually decreases, the right movement is made sooner and sooner, until finally it is done as soon as the cat is put in.

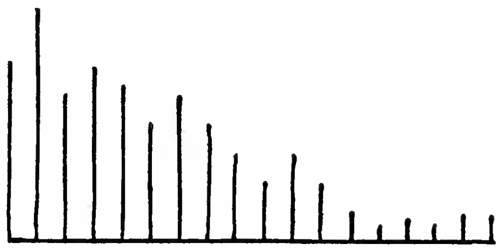


FIG. 2.

This sort of a history is not the history of a reasoning animal. It is the history of an animal who meets a certain situation with a lot of instinctive acts. Included without design among these acts is one which brings freedom and food. The pleasurable result of this one gradually stamps it in in connection with the situation "confinement in that box," while their failure to result in any pleasure gradually stamps out all the useless bitings, clawings, and squeezings. Thus, little by little, the one act becomes more and more likely to be done in that situation, while the others slowly vanish. This history represents the wearing smooth of a path in the brain, not the decisions of a rational consciousness.

We can express graphically the difference between the conduct of a reasoning animal and that of these dogs and cats by means of a time-curve. If, for instance, we let perpendiculars to a horizontal line represent each one trial in the box, and let their heights represent in each trial the time it took the animal to escape (each three millimetres equaling ten seconds), the accompanying figure (Fig. 2) will tell the story of a cat which, when first put in, took sixty seconds to get out; in the second trial, eighty; in the third, fifty; in the fourth, sixty; in the fifth, fifty; in the sixth, forty, etc. This figure represents what did actually happen with one cat in learning a very easy act. Suppose the cat had, after the third accidental success, been able to reason. She would then have the next time and in all succeeding times performed the act as soon as put in, and the figure would have been such as we see in Fig. 3. The thing is still clearer if, instead of drawing in the

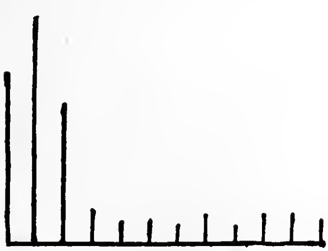


FIG. 3.

perpendiculars, we draw only a line joining their tops. Fig. 4 shows, then, the curve for the real history, and Fig. 5 shows the abrupt descent, due to a rational comprehension of the situation. I kept an accurate record of the time, in seconds, taken in every trial by every cat in every box, and in them all there appears no evidence for the presence of even the little reasoning that "what let me out of this box three seconds ago will let me out now." Surely, if an animal could reason he would, after ten or eleven accidental successes, think what he had been doing, and at the eleventh or twelfth trial would at once perform the act. But no! The slope of the curves, as one may see in the specimens shown in Fig. 6, is always gradual. So, in saying that the behavior of the animals throughout the experiments gave no sign of the presence of reasoning I am not giving a personal opinion, but the impartial evidence of an unprejudiced watch. The curves given in Fig. 6 are for cats learning to escape from the box already described, whose door was held by a wooden button on the inside.

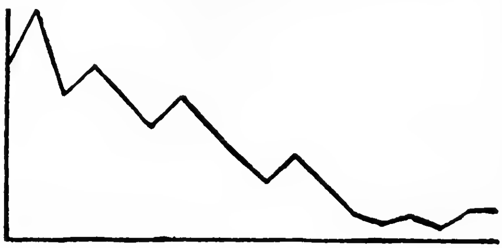


Fig. 4.

Some one may object that, true as all this may be, the intelligent acts reported of animals are in many cases such as could not have happened in this way by accident. These anecdotes of apparent comprehension and inference are really the only argument which the believers in reason have presented. Its whole substance vanishes if, as a matter of fact, animals can do these supposed intelligent acts in the course of instinctive struggling. They certainly can and do. I purposely chose, for experiments, two of the most intelligent performances described by Romanes in his Animal Intelligence—namely, the act of opening a door by depressing the thumb-piece of an ordinary thumb-latch and the opening of a window by turning a swivel (see pp. 420–422 and p. 425 of Animal Intelligence, by G. J. Romanes). Here I may quote from the detailed report of my experiments (Monograph Supplement to the Psychological Review, No. 8):

Fig. 5.

"G was a box $29 \times 20\frac{1}{2} \times 22\frac{1}{2}$, with a door 29×12 hinged on the left side of the box (looking from within), and kept closed by an ordiary thumb-latch placed fifteen inches from the floor. The remainder of the front of the box was closed in by wooden bars. The door was a wooden frame covered with screening. It was *not* arranged so as to open as soon as the latch was lifted, but required a force of four hundred grammes, even when applied to the best

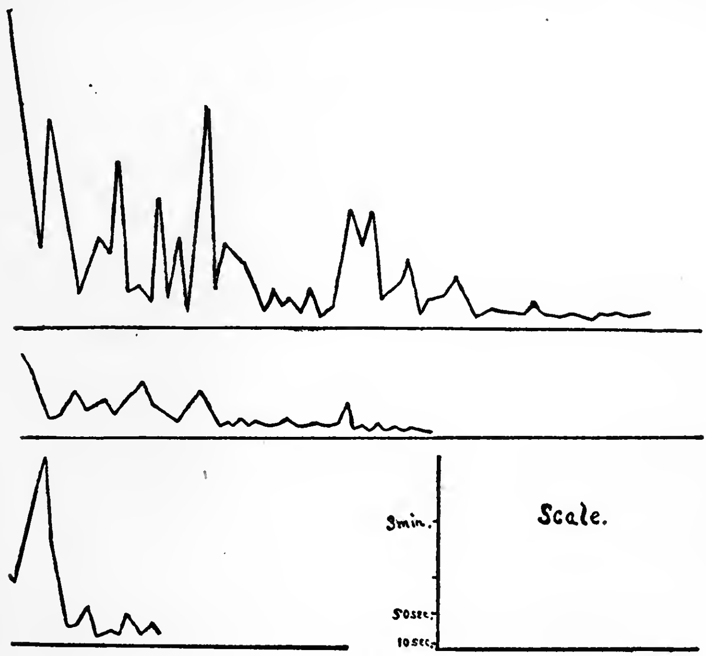


FIG. 6.

advantage. The bar of the thumb-latch, moreover, would fall back into place again unless the door were pushed out at least a little. Eight cats (Nos. 1, 2, 3, 4, 5, 6, 7, and 13) were, one at a time, left in this thumb-latch box. All exhibited the customary instinctive clawings and squeezings and bitings. Out of the eight, *all succeeded, in the course of their vigorous struggles, in pressing down the thumb-piece,* so that if the door had been free to swing open they could have escaped. Six succeeded in pushing both thumb-piece down and door out, so that the bar did not fall back into its place. Of these, *five succeeded in also later pushing the door open, so that they escaped and got the fish outside.* Of these, three, after about fifty trials, associated the complicated movements required with the sight of the interior of the box so firmly that they attacked the thumb-latch the moment they were put in."

In the cases of No. 1 and No. 6 the combination of accidents required was enough to make their successes somewhat rare. Consequently weariness and failure offset the occasional pleasure of getting food, and after succeeding four and ten times respectively they never again succeeded, though given numerous opportunities. Their cases are almost a perfect proof of the claim that accident, not inference, makes animals open doors. For they hit upon the thing several times, but did not know enough to profit even by these experiences, and so failed to open the door the fifth and eleventh times.

Accident is equally capable of helping a cat escape from an inclosure whose door is held by a swivel.

"Out of six cats who were put in the box whose door opened by a button, *not one failed*, in the course of its impulsive activity, to push the button around. Sometimes it was clawed one side from below; sometimes vigorous pressure on the top turned it around; sometimes it was pushed up by the nose. No cat who was given repeated trials failed to form a perfect association between the sight of the interior of that box and the proper movements."

If, then, three cats out of eight can escape from a small box by accidentally operating a thumb-latch, one cat in a hundred may easily escape from a room by accident. If one hundred per cent of all cats are sure to sooner or later turn a button around when in a small box, one cat in a thousand may well escape from a room by accidentally turning a swivel around.

So far we have seen that when put in situations calculated to call forth any thinking powers which they possess, the animal's conduct still shows no signs of anything beyond the accidental formation of an association between the sight of the interior of the box and the impulse to a certain act, and the subsequent complete establishment of this association because of the power of pleasure to stamp in any process which leads to it. We have also seen that samples of the acts which have been supposed by advocates of the reason theory to require reasoning for their accomplishment turn out to be readily accomplished by the accidental success of instinctive impulses. The decision that animals do not possess the higher mental processes is re-enforced by several other lines of experiment—for example, by some experiments on imitation.

The details of these experiments I will not take the time to describe. Suffice it to say that cats and dogs were given a chance to see one of their fellows free himself from confinement and gain food by performing some simple act. In each case they were where they could see him do this from fifty to one hundred and fifty times, and did actually watch his actions closely from ten to forty times. After every ten chances to learn from seeing him, they were put into the same inclosure and observed carefully, in order to see whether they would, from having so often seen the act done, know enough to do it themselves, or at least to try to do it. In this they signally failed. Those who had failed previously to hit upon the thing accidentally never learned it later from seeing it done. Those who were given a chance to imitate acts which accident would sooner or later have taught them learned the acts no more quickly than if they had never seen the other animal do it the score or more of times. The animals, that is, could not master the simple inference that if, in a certain situation, that fellow-cat of mine performs a certain act and gets fish, I, in the same situation, may get fish by performing that act. They did not think enough to profit by the observation of their fellows, no matter how many chances for such observation were given them.

Equally corroborative of our first position are the results of still another set of experiments. Here the dogs and cats were put through the proper movement from twenty-five to one hundred times, being left in the box after every five or ten trials and watched to see if they would not be able at least to realize that the act which they had just been made to do and which had resulted in liberation and food was the proper act to be done. For instance, a dog would be put in a box the door of which would fall open when a loop of string hanging outside the box was clawed down an inch or so. Animals were taken who had, when left to themselves, failed to be led to this particular act by their general instinctive activities. After two minutes I would put in my arm, take the dog's paw, hold it out between the bars, and, inserting it in the loop, pull the loop down. The dog would of course then go out and eat the bit of meat. After repeating this ten times (in some cases five) I would put the dog in and leave him to his own devices. If, as was always the case, he failed in ten or twenty minutes to profit by my teaching I would take him out, but would not feed him. After a half hour or so I would recommence my attempts to show the dog what needed to be done. This would be kept up for two or three days, until he had shown his utter inability to get the notion of doing for himself what he had been made to do a hundred or more times. The mental process required here need not be so high a one as inference or reasoning, but surely any animal possessing those would, after seeing and feeling his paw pull a loop down a hundred times with such good results, have known enough to do it himself. None of my animals did know enough. Those who did not in ten or twelve trials hit upon an act by accident could never be taught that act by being put through it. And, as in the case of imitation, acts of such a sort as would be surely learned by virtue of accidental success were not learned a whit sooner or more easily when I thus showed them to the animal.

An interesting supplement to these facts is found in the following answers to some questions which I sent to the trainer of one of the most remarkable trick-performing horses now exhibited on the stage. The counting tricks done by this horse had been quoted to me by a friend as impossible of explanation unless the horse could be educated by being put through the right number of movements in connection with the different signals.

Question 1.—If you wished to teach a horse to tap seven times with his hoof when you asked him "How many days are there in a week?" would you teach him by taking his leg and making him go through the motions?

Answer.—"No!"

Question 2.—Do you think you *could* teach him that way, even if naturally you would take some other way?

Answer.—"I do not think I could."

Question 3.—How would you teach him?

Answer.—"You put figure 2 on the blackboard and *touch him on the leg* twice with a cane, and so on."

The counting tricks of trained horses seem to us marvelous because we are not acquainted with the simple but important fact that a horse instinctively raises his hoof when one pricks or taps his leg in a certain place. Just as once given, the cat's instinct to claw, squeeze, etc., you can readily get a cat to open doors by working latches or turning buttons, so, once given this simple reflex of raising the hoof, you can, by ingenuity and patience, get a horse to do almost any number of counting tricks.

Probably any one who still feels confident that animals reason will not be shaken by any further evidence. Still, it will pay any one who cares to make scientific his notions about animal consciousness to notice the results of two sets of experiments not yet mentioned. The first set was concerned with the way animals learn to perform a compound act. Boxes were arranged so that two or three different things had to be done before the door would fall open. For instance, in one case the cat or dog had to step on a platform, reach up between the bars over the top of the box and claw down a string running across them, and finally push its paw out beside the door to claw down a bar which held it.

The animal's instinctive impulses do often lead it to accidentally perform these several acts one after another, and repeated accidental successes do in some of these cases cause the acts to be done at last in fairly quick succession. But we see clearly that the acts are not thought about or done with anything like a rational comprehension of the situation, for the time taken to learn the thing is much longer than all three elements would take if tackled separately; and even after the animal has reached a minimum time in doing the acts, he does not do the things in the same order, and often repeats one of the acts over and over again, though it has already attained its end.

The second set comprised experiments on the so-called "memory" of animals. I will describe only one out of many which agree with it. A kitten had been trained to the habit of climbing the wire-netting front of its cage whenever I approached. I then trained her to climb up at the words "I must feed those cats." This was done by uttering them and then in ten seconds going up to the cage and holding a bit of fish to her at its top. After this had been done about forty times she reached a point where she would climb up at the signal about fifty per cent of the times. I then introduced a new element by sometimes saying, "I must feed those cats," as before, and feeding her, and at other times saying, "I will not feed them," and remaining still in my chair. At first the kitten felt no difference, and would climb up just as often at the wrong signal as at the right. But gradually (it took about four hundred and fifty trials) the failure to get any pleasure from the act of climbing up at the wrong signal stamped out the impulse to do so, while the pleasure sequent upon the act of climbing up at the other signal made that her invariable response to it. Here, as elsewhere, the absence of reason was shown by the cat's failure at any point in these hundreds of trials to think about the matter, and make the easy inference that one set of sounds meant food, while the other did not. But still better proof appears in what is to follow. After an interval of eighty days I tried her again to see how permanent the association between the signal and act was. It was permanent to the extent that what took three hundred and eighty trials before took only fifty this time, for after fifty trials with the "I will not feed them" signal, mixed up with a lot of the other, the cat once more attained perfect discrimination. But it was not permanent in the sense that the cat at the first or tenth or twentieth trial felt, as a remembering, reasoning consciousness surely ought to feel, "Why, that lot of sounds means that he won't come up with fish." For instead of at first forgetting and for a while climbing up at the *I will not feed them*, and then remembering its previous experience and at once stopping the performance it had before learned was useless, the cat simply went through the same gradual decreasing of the percentage of wrong responses until finally it always responded rightly.

What has so far been said is true regardless of any prejudice or incompetence on my part, for the proof in all cases rests not on my observation, but on impartial time records or such matters of fact as the escape or nonescape, the climbing or not-climbing of the animals. I may add that in a life among these animals of six months for from four to eight hours a day I never saw any acts which even *seemed* to show reasoning powers, and did see numerous acts unmentioned here which pointed clearly to their absence.

All that is left for the fond owner of a supposedly rational animal to say is that though the average animal, the typical dog or cat, is by these experiments shown to be devoid of reasoning power, yet *his* dog or *her* cat is far above the average level, and is therefore to be judged by itself. He may claim that just because my average animals failed to infer, we have no right to deny inference to all, particularly to his. Is it not fair to ask such a one to repeat my experiments with his supposedly superior animal? Until he does and systematically tries to find out how its mind works and what it is capable of, has he any right to bear witness? It may also be said that of the number of people who witnessed the performances of my animals after they had fully learned a lot of these acts, but had not seen the method of acquisition, all unanimously wondered at their wonderful intellectual powers. "How *do* you teach them?" "Where did you get such bright animals?" "I always thought animals could think," and such like were common expressions of my visitors. The fact was that the dogs and cats were picked up in the street at random, and that no one of them had thought out one jot or tittle of the things he had learned to do. The specious appearance of reasoning in a completely formed habit does not involve the presence or assistance of reasoning in the formation of the habit.

Here, at the close of this account, I may signify my willingness to reply, so far as is possible, to any letters from readers of the Popular Science Monthly who may care to ask questions about any feature of animal intelligence.

In a discussion of the question "How Education fails," Dr. J. T. Searcy, of Tuscaloosa, Alabama, speaks of the tendency of too much education as being to make the pupil too machine-cut. "The successful, the progressive, the aggressive men, families, and races are not the manufactured ones, but the self-made ones." In the conditions and complexities of human society, the accumulating data of knowledge change so rapidly that educators can not anticipate the future in the elements and curricula of prescribed education. The advancing man, who is able to keep up in his day and generation, shows his excellence in his ability to readjust to his changing environment. The schools can not give this faculty, but rather have a tendency to weaken it; yet on it, more than anything else, rests the success of the man and the race. "Too much ought not to be demanded of the schools, nor ought they to assume too much to themselves."

THE UNITED STATES NATIONAL MUSEUM.

By Hon. CHARLES D. WALCOTT,
DIRECTOR OF THE UNITED STATES GEOLOGICAL SURVEY.

A NATIONAL museum should be the center of scientific activity in the country in which it is located. In England the British Museum is the Mecca of scientific men. In Paris, Copenhagen, Vienna, Berlin, and other capitals of Europe the national museum stands in similar relations to the scientific work of its own country. Such a relation our National Museum should hold to scientific men and affairs in America. It should receive and take care of all material that has been or may be valuable for investigation or for the illustration of the ethnology, natural history, geology, products, and resources of our own country, or for comparison with the material of other countries. It should furnish material for all kinds of scientific investigations which deal with specimens or types, and give aid to such researches and publish their results. It should present by illustration such of the results of the scientific investigations of its corps of officers as are susceptible of such representation. It should co-operate with all the higher educational institutions of learning in the country, and assist in the promotion and diffusion of knowledge in all lines of investigation carried on by it. It should provide library facilities, and aid all post-graduate students who may wish to take advantage of the provisions made by the Government for scientific research.

History and Present Organization.—Beginning in a small way in the Patent-Office building early in the century, the "Government" collections of "natural products" were transferred to the custody of the Smithsonian Institution in 1858, where they were installed along with the larger and more valuable collections of the institution. Twenty-three years later, in 1881, the present National Museum building was ready for the great mass of material that had accumulated in the Smithsonian building, and had been transferred from the Centennial Exhibition at Philadelphia. Out of these heterogeneous collections Dr. G. Brown Goode, under the direction of Secretary Baird, of the Smithsonian, organized a museum of broad scope, based on all that had proved best in museum experience to that time. Faithfully he carried forward the work until September, 1896, when his health broke under the strain of too many duties, and one of the best museum administrators the world has yet produced, if not the very best one, passed from us. In January, 1897, I was placed in temporary charge of the administration of the museum as an acting Assistant Secretary of the Smithsonian Institution, and remained in charge until July 1, 1898.

On July 1, 1897, in order to meet changed conditions, a new plan of organization went into effect. The various divisions and sections of anthropology, biology, and geology, which had previously been conducted independently of one another, the curators and custodians reporting directly to the assistant secretary in charge of the museum, were united under three head curators—one of anthropology, another of biology, and a third of geology. This secured direct expert supervision, and correlated the work of each department. Before this such correlation had been impossible, owing to the large number of independent heads of sections and divisions in each department, who planned and executed the work more or less independently of one another.

In the department of anthropology the system of installation inaugurated by Prof. W. H. Holmes is somewhat elaborate. The primary arrangement is founded, first, on the geographical or ethnographical assemblage, and, second, on the developmental or genetic assemblage. Other methods may be classed as special; they are the chronologic, the comparative, the individual, etc. The primary methods are adapted to the presentation of the general truths of anthropology, and the special methods are available for limited portions of the field.

In many ways the department of biology, under the charge of Dr. F. W. True, was, at the date named, in much better condition than either of the other two departments. Many of the zoölogical divisions had been in existence since the reorganization of the museum in 1883, and several of them for a much longer period, and as the biological specimens had been in charge of curators and assistants who followed well-defined and long-established methods, the reorganization of the department was a relatively simple matter, no radical changes in the scientific methods or in the business administration being required.

To the organization and administration of the department of geology, Dr. George P. Merrill brought the results of a recent study of various European museums. He found it necessary to make a systematic examination of the written and printed records of the various Government exploring expeditions and surveys, with a view to ascertaining what geological material had been collected which could properly be considered the property of the Government, and what disposition had been made of the same. The law * provides

* "And all collections of rocks, minerals, soils, fossils, and objects of natural history, archæology, and ethnology, made by the Coast and Interior Survey, the Geological Survey, or by any other parties for the Government of the United States, when no longer needed for investigations in progress, shall be deposited in the National Museum. . . ."—*Supplement to the Revised Statutes of the United States*, vol. i, second edition, 1874–1891, p. 252.

that collections made for the Government shall, when no longer needed for investigations in progress, be deposited in the National Museum. It was found that this law had not in all cases been strictly enforced, and that several important collections had not been transferred to the museum, although some of the earlier exploring expeditions had passed out of existence, and in several instances the individuals making the collections had likewise passed away. This investigation has resulted in the transfer to the museum of several car loads of specimens no longer needed elsewhere.

The National Museum is unique among permanent museums in having large sections of its collections almost constantly away from it. It made displays at London in 1883, at Louisville in 1884, at Minneapolis in 1887, at Cincinnati and Marietta in 1888, at Madrid in 1892, at Chicago in 1893, at Atlanta in 1895, at Nashville in 1896, and at Omaha in 1898. The injury to the museum resulting from the packing and transportation of specimens and from the interruption of systematic work and development has been keenly felt at times by the scientific staff. The advantages have consisted in showing to the people of many sections of the country what the museum is doing, in securing collections that otherwise would not have been obtained, and in extending the educational sphere of influence.

Relations to the Smithsonian Institution.—The museum is a child that has by its vigorous growth already overshadowed the parent institution in the extent of its buildings, its expenditures, and its direct influence upon the people of the United States. In the larger fields for which the Smithsonian Institution was organized, for the purpose of increasing and diffusing knowledge among men throughout the world, the museum is subordinate to the institution, and if the latter is administered in the future as it has been in the past, it will continue to hold a unique place among all institutions for the increase and diffusion of knowledge.

In 1877 Prof. Asa Gray, as chairman of a special committee of the Regents of the Smithsonian, submitted a report which recommended that a distinction between the institution itself and the museum under its charge should be made as prominent as possible. The fear was expressed that if the museum was developed to its full extent and importance within the Smithsonian Institution it would absorb the working energies of the institution, and it was thought that such a differentiation would pave the way to entire separation of administration or to some other adjustment, as the Board of Regents might think best or be able to accomplish. Professor Baird, in 1878, in his report to the regents, called attention to the frequent mention in the reports of his predecessor of the relations existing between the Smithsonian Institution and the National Museum, and remarked that "it is only necessary to mention briefly that the museum constitutes no organic part of the institution, and that, whenever Congress so directs, it may be transferred to any designated supervision without affecting the general plans and operations connected with the 'increase and diffusion of knowledge among men.'"

During the administration of the museum by Dr. Goode, under the direction of Professor Baird, and later Professor Langley, no movement was made toward the separation of the museum from the Smithsonian. On the contrary, Dr. Goode was strongly opposed to any such action, and in this he was heartily supported by Secretary Langley. He felt that the result of placing the museum under the control of one of the great departments of the Government, or leaving it to be buffeted about in the sea of politics as an independent organization, would be the destruction of its scientific character.

I have been intimately acquainted with the administration of the museum since 1886, and less so with the administration of other scientific bureaus of the Government, one of which, the Fish Commission, is independent of departmental control. After a careful reconsideration of the subject of the relations of the National Museum to the Smithsonian Institution, I have come to the conclusion that the present welfare and the future development of the museum will be best served by administrative connection with the Smithsonian Institution. Under the present organization there is no necessity for large demand upon the time and energies of the secretary by the affairs of the museum. If in the future it should become otherwise, relief could readily be secured by action of the Board of Regents, requiring the officer in charge of the museum to report to them through the secretary, much as the various bureaus of the departments report through their respective secretaries to Congress. It is not probable, however, that this will become necessary, for at any time an assistant secretary could be appointed to take sole charge of the museum, thus relieving the secretary of all but the most general administrative supervision.

Relations to a National University.—A national museum should radiate an educational influence to the remotest portions of the country. It should set the standard for all other museums, whether in public school, academy, college, university, or the larger museums under municipal and State control. Its influence should be exercised largely through its publications and through those who come to study its collections and the methods of work of the investigators connected directly or indirectly with its scientific staff.

In its library system the student should have access to the literature bearing upon the subjects with which the museum is concerned. In its exhibition halls each object should be labeled and arranged with the view of presenting, by graphic illustration and concise description, all that it is capable of teaching, either as a discrete object or as one of a series of objects telling the story of the evolution of the group to which it belongs. Such a museum is not a place where the uninformed student may obtain the elements of a university training; it is an institution where the post-graduate student can secure access to material for study and research in connection with men who are carrying forward scientific work of the highest type. Dr. D. C. Gilman would go further than this. He says: *

"Any person of either sex, from any place, of whatever age, without any question as to his previous academic degree, should be admissible; provided, however, that he demonstrate his fitness to the satisfaction of the leader in the subject of his predilection."

Dr. Gilman thinks that such an organization "may be developed more readily around the Smithsonian Institution, with less friction, less expense, less peril, and with the prospect of more permanent and widespread advantages to the country, than by a dozen denominational seminaries or one colossal university of the United States.

"To the special opportunities that the Smithsonian and its affiliations could offer, every university, at a distance or near by, might be glad to send its most promising students for a residence of weeks, months, or years, never losing control of them. Many other persons, disconnected with universities, but proficient to a considerable degree in one study or another, would also resort with pleasure and gratitude, and with prospect of great advantages, to the rare opportunities which Washington affords for study and investigation in history, political science, literature, ethnology, anthropology, medicine, agriculture, meteorology, geology, geodesy, and astronomy."

I fully agree with him, but would make the National Museum the center of activity, rather than the Smithsonian Institution. It would then be under the control of the Board of Regents, through the secretary or the assistant secretary, who could have direct charge. It seems to me that the function of the Smithsonian Institution is to aid at the beginning of such a movement, and then place the administration in charge of one of its bureaus or transfer it to some other suitable organization.

With the National Museum as a center or base, the student in Washington may avail himself of the Library of Congress and of

* Century Magazine, vol. lv, 1897, p. 156.

the facilities offered for study and investigation by the various scientific bureaus of the Government, such as the Fish Commission, the Zoölogical Park, the Geological and Coast and Geodetic Surveys, the Naval Observatory, and the Weather, Botanical, Biological, and Entomological Bureaus of the Department of Agriculture, and systematic courses of lectures will place before him the most advanced ideas and conclusions of the largest body of scientific investigators in the world.

A single well-trained man, with a few assistants, could render invaluable aid to hundreds of post-graduate and special students, whose only need is direction as to the best means of pursuing studies and investigations. Such an organization could be located in the administrative building that it has been proposed to erect as a nucleus of the National University. From this beginning a national university of the broadest type could be developed with as much rapidity as the educational interests of the country might demand.

The National Museum can not at present give facilities to more than a score of students, but with the erection of a modern museum building, well equipped with laboratory space and a suitable staff to conduct the necessary work of installation and investigation, the scientific side of the National University would be established. It should be remembered that many of the officers of the scientific bureaus of the Government are directly connected with the museum staff as honorary curators and custodians, and that a number of them have laboratories within the museum building.

Need of a New Building.—The growth of the United States National Museum was rapid under the successful administration of Dr. Goode. When the character of the building and the funds available for the maintenance of the museum are considered, it compares favorably with any modern museum. It has received large collections from the scientific departments of the Government, by private contribution, by purchase, and by exchange, which have been accommodated as well as possible in the inadequate laboratories, storerooms, and exhibition spaces. During the fiscal year 1897–'98, accessions to the number of 1,441 were received, containing upward of 450,000 specimens—the largest number for any one year since the museum was opened. The total number of specimens recorded to July 1, 1898, exceeds four million. The galleries just completed have added sixteen thousand square feet of floor space, which is available for the spreading out and proper exhibition of material that has previously been crowded in the exhibition halls and courts on the floor; but, as an illustration of the present congested conditions, it may be stated that the anthropological collections now in the possession of the Government, illustrating the development and progress of man and his works, if properly placed on exhibition, would occupy the entire space in the present museum building. The great collections in biology, botany, economic geology, general geology, and paleontology should be placed in a building properly constructed for their study and exhibition. A considerable portion of the collections are still in the Smithsonian building, where the crowding is scarcely less than in the museum building.

Moreover, in the present building there is great deficiency in laboratory facilities. Curators and assistants are hampered for want of room in which to lay out, arrange, classify, mount, and label specimens. There should also be rooms in which students could bring together and compare various series of objects, and have at hand books and scientific apparatus. The present museum building contains a few rooms suitable for the purposes mentioned, but the majority have to be used as storerooms, laboratories, and offices, and are therefore too much crowded to serve in any one of these capacities. Owing to the pressure for space, courts, halls, and galleries intended for exhibition purposes, both in the Smithsonian building and in the museum building, are unavoidably occupied to a considerable extent as laboratories and storerooms. There is also need of storage room, an increase of the scientific staff, and a purchasing and collecting fund. The American Museum of Natural History expends annually $60,000 for the increase of its collections; the National Museum has from $3,000 to $4,000 for the purpose.

The immediate and greatest need, however, is a suitable museum building. The present building is 375 feet square. The space on the ground floor is 140,625 square feet, and that in the galleries 16,000 square feet; exhibition space, 96,000 square feet. The entire cost is $315,400.

For comparison with the above figures, the following statistics relating to the American Museum of Natural History in New York are given: Total floor space, 294,000 square feet, divided as follows: Exhibition space, 196,000 square feet; laboratories, library, etc., 42,500 square feet; workrooms, storage, etc., 42,000 square feet; lecture hall, 13,500 square feet. These figures include the portions of the building now being completed. The total cost of the museum to date, including the completion of the new wings, is $3,559,470.15. The buildings, and the care of them, are provided for by the city of New York. The expenses of the scientific staff, increase of collections, etc. (the income for which for the present year is approximately $185,000), are defrayed from endowments, membership fees, and contributions. In the capitals of Europe, museum buildings are generously provided for.

The National Museum building was erected with the view of covering the largest amount of space with the least outlay of money. In this respect it may be considered a success. It is, in fact, scarcely more than the shadow of such a massive, dignified, and well-finished building as should be the home of the great national collections. There is needed at once a spacious, absolutely fireproof building of several stories, constructed of durable materials, well lighted, modern in equipment, and on such a plan that it can be added to as occasion arises in the future. The site for such a building is already owned by the Government; only the building needs to be provided for. What the Capitol building is to the nation, the library building to the National Library, the Smithsonian building to the Smithsonian Institution, the new museum building should be to the National Museum. There should be available:

	Sq. ft.
Department of biology	190,000
Department of geology	83,000
Special laboratories for students	5,000
Rough storage, workshops, etc.	20,000
Lecture hall	6,000
Total	304,000
Present museum space to be devoted to the department of anthropology	96,000
Grand total	400,000

Future Development.—With suitable buildings provided, the immediate development of the National Museum naturally lies in four directions: (1) The occupation of the present building by the anthropological collections; (2) the housing, developing, and installing of the large biological collections; (3) the development of a great museum of practical geology; and (4) the development of the scientific side of a National University.

1. The collections in anthropology, as they stand to-day, cover a wide field in a broken and disconnected way. It is difficult to use them effectively to illustrate the great features of this branch of science. They do not present a connected story of the peoples and cultures of the world. This arises from the gaps in the collections and the absence of suitable laboratory and exhibition space. This department should have adequate representations of the American peoples and their culture, not only of our own country, but of the whole American continent. Our nation is the only one in America that can reasonably be expected to do anything of importance toward the preservation of the materials necessary for the illustration

of this vast field; and as the American race is a unit, of which the tribes in our own territory constitute a considerable part, it appears to be our duty to take up this work in a comprehensive way. Thus would be built up not only a National Museum, but an American Museum in the widest sense. This applies not only to anthropology, but to the other great departments of the museum. It will be impossible to carry on such a work without turning over to the Department of Anthropology the entire present building, with all its laboratory and exhibition space.

2. The Department of Biology now occupies a large exhibition space in the Smithsonian building and 55,000 square feet in the museum building. Large collections are stored in laboratories and inclosed spaces in the exhibition halls which would be placed on exhibition if space were available. As has already been explained, in a new building there should be available for the Department of Biology 190,000 square feet of exhibition, laboratory, and storage space.

The present exhibit is more complete than that of the other departments of the museum. Of birds there is a large mounted series, one of the finest in existence, but it is so indifferently housed that it fails to make the impression it should. Of mammals there is a good North American series, and there are some excellent examples of exotic species. There is a good and rather large exhibit of the various groups of the lower forms of animals, including an especially fine series of corals and sponges. These are the only series at present exhibited which can be considered at all comprehensive. Of the great groups of fishes, reptiles, and amphibians there is room only for an outline representation. The wonderful variety of form among insects can be scarcely more than suggested in the space available. Of plants there has hitherto been no exhibit worthy of the name, and the space which it has now been possible to set aside is entirely out of proportion to the vast extent and importance of this great kingdom of Nature.

Every natural-history museum of the first class should have at least two comprehensive exhibition series. The first, the *Systematic Series,* is a series representing the natural groups, among which all animals and plants, from the highest to the lowest, are divided. The second, the *Faunal and Floral Series,* is a series showing the animals and plants characteristic of each of the grand divisions of the earth's surface, which naturalists have established as a result of their study of these two kingdoms of Nature. These two great comprehensive exhibits should be supplemented by a number of *Special Series,* illustrating the more interesting phenomena and phases of life, such as the macroscopic and microscopic structure of animals and plants and their development from the germ to the fully adult individual, and special modifications of form and color by which animals are protected from their enemies; the adaptations for peculiar environments and modes of life; the characteristics of youth, maturity, and old age; the variation in form, size, and color among individuals of the same species; the domiciles and other works constructed by birds, mammals, insects, and the like. To these series should be added another of great importance, the *Economic Series*, representing the animals and plants as related to the activities and needs of man. Any one of these principal series in its full development would more than fill the entire space now available.

3. There should be developed a museum of practical geology in the broadest sense, which will be of service to every producer and consumer of American mineral products, and to all students of geology who are engaged in either economic or purely scientific investigations.

In addition to the series of rocks and fossils illustrating the stratigraphy and succession of the sedimentary rocks and the systematic collection of minerals and ores, an exhibit showing how geologic work benefits the daily life of the people should be developed. An illustration of this would be a representation of the artesian-water supply of the semi-arid region, showing the stratification and structure of the sedimentary rocks, and how hydrographic and geologic investigations clearly indicate the regions in which artesian-water development may be carried on successfully. Mining and areal geology could also be illustrated in such manner as to place before the student and intelligent observer the import and value of such work.

In most museums the principal effort has been to make a collection of useful mineral products. This is desirable, but, from the broad view of illustrating the practical in addition to the scientific side of geology, it should be secondary. The best basis for classification on the practical side of the museum exhibit appears to be the finished mineral product. For instance, if pig iron be taken as a key material in classification, the iron ores from which it has been obtained should be arranged so as to show the various kinds whose combination has resulted in the pig iron. In connection with this should be grouped the geologic phenomena, which should include any geologic conditions connected with the original deposition and the occurrence of iron ores. This might include the conditions which have led to the oxidation of pyrite and other sulphur compounds of iron, and to the development of hydrous oxides of iron; also an illustration of what has been demonstrated in regard to the solution of widely distributed minerals in certain rocks, and their subsequent concentration in ore bodies by metasomatic action. All the metals could be arranged under such a classification, as also the nonmetallic products. The preparation of such an exhibit would require many years of work, the details of which would be considered as each mineral product was taken in hand.

4. The fourth direction of development is toward the requirements of a National University, which has already been sufficiently dwelt upon in this connection.

Children's Museum.—The children gain a fair amount of information from the general exhibit in any well-arranged museum, but it is desirable that their interest should be aroused by having certain exhibits made expressly for them. I would have a space set aside in each of the three departments in which nothing should be exhibited except for the children. It might be called a Museum Kindergarten.

Some of the preceding suggestions have been adopted by the museum authorities and partially put into execution, and the carrying of them out is dependent upon enlarged facilities for laboratory work and exhibition space. During the administration of Dr. Goode the museum developed as far as possible under the conditions surrounding it. No one knew better than he that only by securing new buildings and expanding the museum could it take the place in America that the several national museums of Europe have taken in their respective countries. It is well recognized that a public museum is a necessity in every highly civilized community, and that, as has been so well stated by Dr. Goode, "the degree of civilization which any nation, city, or province has attained is best shown by the character of its public museums and the liberality with which they are maintained." At present New York city is, in this respect, in advance of all other American cities and of the national Government. Whether the latter will take its proper place by developing the National Museum as it has developed the National Library remains to be seen. The question whether they are willing to be represented by the museum as it is to-day is one that the American people should consider and decide at an early date; meantime, it is the duty of all interested in the advancement of science and education to aid by every means in their power the development of a National Musum that will be truly national and American.

ARE JEWS JEWS?

By JOSEPH JACOBS,
PRESIDENT OF THE JEWISH HISTORICAL SOCIETY.

IN the December (1898) and January (1899) numbers of Appletons' Popular Science Monthly Prof. William Z. Ripley concludes the remarkable series of articles on the Racial Geography of Europe, originally delivered as Lowell Institute lectures, by a couple of articles on the Jews. Strictly speaking, the articles might seem to have no right in the particular series in which Professor Ripley has included them, since their main object is to show that the Jews are not a race but a people, and have therefore no claim to be considered in the racial geography of any continent. But one can not regret that a daring disregard for logic has caused Professor Ripley to conclude his interesting series with the somewhat startling paradox that Jews are not Jews, in the sense of the word in which both their friends and their enemies have hitherto taken it. As Professor Ripley has been good enough to refer to me as having written with some authority on the subject, and as I have not been convinced by his arguments against the comparative racial purity of the Jews, I am glad of an opportunity to discuss the question, which is of equal theoretic and practical interest.

The theoretic interest, with which alone we need concern ourselves here, seems to me of two kinds. Professor Ripley, as a student of anthropology, declares, as the result of his inquiries, that there has been so large an admixture of round skulls with the (hypothetically assumed) original long skulls of the Hebrews that all signs of racial unity have disappeared. I, on the other hand, who have approached the subject as a student of history,* see no evidence of any such large admixture of alien elements in the race since its dispersion from Palestine, and have come, therefore, to the opposite conclusion—that the Jews now living are, to all intents and purposes, exclusively the direct descendants of the Diaspora. Here, then, anthropology and history—if Professor Ripley and I have respectively interpreted their verdicts aright—appear to speak in two opposite senses, and no conference at La Hague or elsewhere can appoint a court of appeal which can decide between contrary propositions by two different sciences.

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* To prevent misunderstanding, I should perhaps add that I have not neglected the anthropological aspects of the question. My paper on The Racial Characteristics of Modern Jews, which appeared in the Journal of the Anthropological Institute for 1885, contained, I believe Professor Ripley would allow, the fullest account of Jewish anthropometry collected up to that date.

But the point in discussion seems to me to raise also a problem of exceeding interest within the anthropological sphere itself. Professor Ripley assumes that round heads beget round heads, and long heads descend from long heads for all time unchanged. That appears to carry with it the assumption that no amount of brain activity can increase the mass of brain, that skull capacity has no relation to mental capacity, and that alone among the organs of the body the brain and skull are incapable of growth, change, or development. The *crux* of Jewish anthropology raises this problem, as I shall proceed to show, and, if I have interpreted history aright, offers valuable material toward its solution.

I might have met Professor Ripley's arguments on narrower grounds, which would have enabled me to evade this larger question. His main, I might say his solitary, argument is that contemporary Jews are predominantly brachycephalic, or round-headed, whereas contemporary Arabs, whom he takes as the type of the Semites, are as predominantly dolichocephalic, or long-headed. Accepting Professor Ripley's own criterion of purity of race, I might point to the almost universal round-headedness of the Jew as a proof of their racial unity. The fact that Arabs do not share that quality really does not affect the question. Linguistically and geographically the Hebrews of history were associated with the Aramæans and Assyrians of Asia Minor, and Professor Ripley himself allows that Asia Minor was mainly brachycephalic. Till Professor Ripley brings forward craniological evidence that the cephalic index of the ancient Hebrews was below 77.8, his reference to the contemporary Arab must be ruled out of court. But, quite apart from this, the Arabic evidence would be of little significance, since the chief characteristic of Moslem civilization has been the predominance of marriage by capture and descent from slave concubines. Every caravan that has entered Arabia for the last twelve hundred years has had its contingent of female slaves of alien race, mainly from dolichocephalic Africa. I must confess my surprise that Professor Ripley has based his main argument on the shifting sands of Arabic racial purity.

The only attempt Professor Ripley makes toward a proof that the pure Hebrew is dolichocephalic is a half-hearted endeavor to claim that quality for the Sephardim, or Spanish and Portuguese Jews, descended in the main from Jewish refugees from Spain and Portugal in 1492. As a matter of fact, the largest number of measurements of Sephardic heads has been made by Mr. Spielman and myself,* and of the fifty-one heads examined by us only eight were

* On the Comparative Anthropometry of English Jews, in the Journal of the Anthropological Institute for 1889.

long-headed. Professor Ripley gives a portrait of a Tunisian Jew, with index 75, who is also probably of Sephardic origin, like most of the Jews of the Mediterranean littoral. But, curiously enough, there is far more evidence for the mixture of race among contemporary Sephardim than of any other branch of Jews. Even while they were living in Spain as avowed Jews they were persistently accused of intermarriage, chiefly with the Moors, while a large number of contemporary Sephardim are descended not from refugees of 1492, but from the so-called Marranos—Jews who remained in Spain, professing Christianity and marrying tolerably freely among the surrounding population. If one wished to be hypercritical, one could trace the long-headedness of a minority of Jews to this admixture of race from Spain.

After all, I must insist that it is to history one must go to determine a question of this sort. Jews have shown such marked individuality throughout their career for the last two thousand years among the nations—they have been so much in the world's eye throughout that time—that any appreciable degree of intermarriage would not have escaped notice, both by themselves and by their enemies. Now there is practically no evidence of this kind during the Christian era. Religious antipathy has been so strong throughout that period as to form an almost insurmountable barrier to intermarriage and the consequent proselytism to Judaism which is necessary for a valid Jewish marriage. Sporadic cases doubtless occur, but their very infrequency drew attention to them, and all that historical research can discover is under one hundred cases throughout the middle ages, scattered through Europe. Jewish nomenclature has special formulæ to name the proselyte, and yet, though we have hundreds of the mediæval lists of Jewish communities and martyrologies, it is the rarest thing in the world to find one of these names referred to as "sons (or daughters) of Abraham our father." In earlier days, doctors of the Talmud, when discussing hypothetical cases, dismissed that of the proselyte as being so rare.* In my Memoir in the Journal of the Anthropological Institute for 1885 I have taken the marriage statistics of modern Algeria as most nearly representing the most favorable conditions that one could imagine at any time during the middle ages, and have found that during nearly half a century (1830–'77) there were only thirty mixed marriages out of an average population of twenty-five thousand Jews—not one a year. The only instances of proselytism on a large scale are those of the Chozars in southern Russia, converted to Judaism in the eighth century, and the Falashas of Abyssinia, about the same time. Yet these are an indirect

* Babylonian Talmud, Gittin, 85a.

proof, by the method of difference, of the comparatively pure descent of the rest of the Jews, for neither the Karaites, who are the descendants of the Chozars, nor the Falashas show any of the characteristic Jewish features or expression.

Those who contest the purity of the Jewish race lay great stress upon the Chozars as forming the nucleus of the Russian Polish Jews, who are, as is well known, a predominant majority among present-day Jews, probably ninety per cent of whom either dwell in the Russian dominions or are descended from former inhabitants of old Poland. Yet against this is the absence of any reference to Jews in Poland during the time the Chozars flourished (eighth to eleventh centuries), while the very speech of the Polish Jews—the so-called "Yiddish," really archaic German mixed with Hebrew—indicates their true source, the German kingdoms and principalities. Professor Ripley throws some doubt upon the possibility of such large numbers as those of the Polish Jews having been derived from Germany. Nowadays there are probably five millions of Jews in the regions once possessed by Poland, but the remarkable fertility of Jews is one of the most striking characteristics of their vital statistics, to which, indeed, Professor Ripley has called attention in his remarks upon their vitality. The development of a generation depends, as is well known, upon the relative number of deaths under five years of age, and it is just at this period that Jewish mortality presents so favorable an aspect, owing to the care of Jewish mothers and the absence of alcoholism among the fathers. I have estimated that the Jewish population of the world in 1730 (six generations ago) was only 1,300,000, whereas at the present moment it is at least nine times as much. If one could assume the same rate of progress to have existed through the middle ages the Jewish population in the fourteenth century would have been not much more than 25,000. Such a rate of progress is, however, extremely unlikely, considering the large losses by persecution, which in Poland alone, during the disastrous Cossack inroads between 1648 and 1656, is said to have removed no less than 180,000 Jews. But, making every allowance for this disturbance in the rate of progress, it would have been quite possible for 50,000 Jews who had migrated to Poland in the thirteenth and fourteenth centuries to increase to over half a million at the beginning of the eighteenth. Americans, who have seen nearly half a million Russian Jews land upon their shores within the last twenty years after crossing nearly half the world, need not be incredulous as to the possibility of one tenth of that number passing over the borders between Germany and Poland in a couple of centuries during the middle ages, when, if means of transit were less numerous, intensity of persecution and motives for emigration were ten times as strong as even under the iron rule of the Russian Czar.

History, then, as I read it, has nothing to say against the purity of descent of contemporary Jews from those of the Bible. What has anthropology, as interpreted by Professor Ripley, to produce against this negative evidence of history? Mainly, it would appear, the fact that Jews of the present day are predominantly brachycephalic. Of the fact there can be little doubt. The list given by Professor Ripley in the Popular Science Monthly (vol. liv, page 340), of over twenty-five hundred heads, would be sufficient to establish this. But the very uniformity of the index is almost sufficient by itself to refute the deduction Professor Ripley draws from it. If there had been any general amount of admixture, that would have tended rather to produce variety than uniformity. Surely Professor Ripley does not contend that the Jewish young men and maidens, who, on his theory, so freely welcomed outsiders into the family circle, have never fallen in love with long-headed persons of the opposite sex. His argument requires that the original Jews of the Diaspora were long-headed, and that they have uniformly intermarried with the broad-headed varieties of the genus *homo*. Now, he adduces no evidence whatever that Jews originally were dolichocephalic, and even if he succeeded in proving this he would have the further difficulty of finding a European race with skulls so broad as to raise the average index of the race considerably over 80. If we assume that the original index of the Jewish skull was 75, Professor Ripley would have to find some race with an average index of nearly 90 before the mixture would raise the contemporary Jewish skull to its present broad-headedness. Dr. Ammon has shown * that there are only two small regions in Europe where such abnormally broad skulls exist, neither of them centers of Jewish population.

But Dr. Ammon has shown more. By comparison with the skulls found in the long barrows in Germany, he shows that the index of German skulls has risen from 77 to no less than 83 during the last thousand years or so; and he further shows, by reasoning similar to that which I have just given, that this rise in index can not be due to any admixture of race. Now, to what is this rise in head index due? Dr. Ammon, who is a professed disciple of Weismann, does not go into the question of causation, but the simplest and most obvious explanation is that cranial capacity has followed brain development, and that, roughly speaking, brachycephalism implies intellectual development. A few instances may be given, confirming this impression of the superior intellectual capacity of

* Die Natürliche Auslese beim Menschen, Jena, 1883.

the broad-headed. Prof. Karl Pearson, in his Chances of Death (vol. i, page 205), has given the following sexual ratios of the superiority of English, German, and French men over the opposite sex:

	English.	German.	French.
Brain weight	1.120	1.117	1.125
Skull capacity	1.179	1.126	1.164
Stature	1.081	1.078	1.069

In other words, men's skulls contain about eight per cent more and their brains weigh four per cent more than women's, even allowing for the difference in height. So, too, there is a uniform increase of cubic capacity from the skulls of the Australians (75 cubic centimetres) up to the Teutons (93.5 cubic centimetres).* The same authority gives the average weight of brain in a number of brachycephalic individuals as 1,314 grammes, as against 1,287 grammes for dolichocephalic cases.† Professor Pearson points out that the higher the caste in India the broader the skull, the Brahmans being highest, with an index of 78.86, according to the measurements of Risley. The same writer gives a long list (page 290) of the indexes of skulls of some thirty-seven races, ranging from Australians at the bottom of the list, with 70.34, and headed by mediæval Jews (only twelve skulls), with an index of 84.74. Every indication seems to point out that in races where progress depends upon brain rather than muscle the brain-box broadens out as a natural consequence. Little investigation has as yet been made as to the influence of brain development on the form of the skull, but what little has been done all points in the same direction. Dr. Giulio Chiarugi ‡ has made some careful measurements of twenty-one brains, and has shown that in every instance there is much greater complexity of the cerebral convolutions in the brachycephalic as compared with the dolichocephalic skulls, in which the brains were contained. From the nature of the sutures of the skull it is tolerably obvious that if brain capacity produces an enlargement of brain, the consequent internal pressure on the skull will be lateral and tend to produce brachycephalism. The application of all this to the case of Jews seems obvious. If they had been forced by persecution to become mainly blacksmiths, one would not have been surprised to find their biceps larger than those of other folk; and similarly, as they have been forced to live by the exercise of their brains, one should not be surprised to find the cubic capacity of their skulls larger than that of their neighbors. When it is remembered that

* Topinard, Éléments d'Anthropologie, 1885, p. 612. † Ibid., p. 568.

‡ La Forma del Cervello umano e le variazioni correlative del Cranio, Siena, 1886.

they are, owing to their persecutions, the shortest of all European folk, their relative superiority in brain comes out even more strikingly.

The conclusion I have thus drawn from anthropological data receives remarkable confirmation from the results of an inquiry I made on the Comparative Distribution of Jewish Ability, and contributed to the Anthropological Institute in 1886. Applying the methods of Galton, I compared the celebrities produced by the Jewish race during the last hundred years with those of Englishmen and Scotchmen, and came to the conclusion that the race, as a whole, took rank between Scotchmen and Englishmen in intellectual capacity, while if the comparison had been confined to western Jews, who alone have had an opportunity of displaying their talents, they would have come out superior to both. From the anthropological side we should expect that the brachycephalism of Jews would show itself in superior mental capacity, and this is confirmed by the number of distinguished persons of Jewish blood recorded in the European dictionaries of biography.

The anthropological and sociological importance of this result, if confirmed by further inquiry, seems to me of very great significance for the science of anthropology, and for this reason I have insisted so much upon it. Skull capacity and cephalic index are not so much indications of race as of intellect. If it is found that, as a rule, each race, and even each people, tends to have a uniform cephalic index, that would merely imply that the sociological conditions of the said race or people were tolerably uniform as regards intellectual development. Australians, who have had no opportunity of pitting their wits against any other competing race, and have depended for their existence on the fleetness of their legs and the capacity of their stomachs to carry food from one orgy to another, have used their brains less than all other human races, and have the narrowest skulls of all. Teutons, who have had the largest sphere for intellectual rivalry with their neighbors, have the broadest skulls of all except the Jews, who have, so to speak, lived by their wits the last two thousand years. The evidence produced by Professor Ripley of long-headed Jews among the lower developed communities only shows that where the brain is not much exercised the skull is not broadened.

So far, then, from history and anthropology giving contrary verdicts with regard to the racial purity of the Jews, the above considerations would seem to show that they rather confirm one another's interpretation of the facts. If brain capacity and skull index follow the intellectual struggle for existence, we should not be surprised to find the Jews mostly broad-headed. If there had been much intermixture with races who had less cause to exercise their brains in the struggle for existence, we might expect a greater admixture of dolichocephalism among them. To my mind a much stronger case could have been made out for the admixture of the Jews by the large number of blondes among them, ranging to about twenty per cent, but, as a rule, in Europe blond types are dolichocephalic, and the evidence of admixture that could be drawn from the admixture of blue eyes or brown hair among the Jews is counterbalanced by that very evidence of their uniform round-headedness, upon which Professor Ripley lays so much stress. In the memoir I have frequently quoted I have given reasons for believing that there was a blond as well as a brunette type among the ancient Jews, and till evidence is shown to the contrary the presence of the fair Jew is only an indication of descent from the earlier blond strain of the race.

Professor Ripley has scarcely taken into account the more positive arguments I have adduced in my memoir for the comparative purity of Jewish descent. I have pointed out a definite class of Jews—the Cohens, or priestly descendants of Aaron—who can not, according to Jewish law, marry proselytes. These still constitute, I have calculated, some five per cent of Jews even at the present day. He appears to think that this is merely a matter of name, and asks how I would explain the existence of quasi-Jewish names, such as Davis, Harris, Phillips, and Hart, among Christian populations of the Anglo-Saxon world. As a matter of fact, it can be proved that, on the contrary, these names among the Jews have been adopted for "mimicry" reasons from the corresponding Christian names which are mostly derived from the Bible. But, at the best, Professor Ripley's argument would merely prove a certain amount of Jewish blood among the Christian populations of Europe and America, which nobody would deny. That Jews, under the pressure of persecution or for other reasons, have abjured their faith, married Christian wives, and become merged in the surrounding populations, is undoubtedly a fact, but does not in any way affect the relative purity of the "remnant" which has remained true to its faith. It certainly does not affect the very important fact that the ancestry of at least five per cent of Jews at the present day can not have married proselytes, owing to the rigid requirements of Jewish law.

So far as I understand the latter part of Professor Ripley's second article, he appears to contend that the remarkable similarity of the Jewish physiognomy all over the world has no force in proving their racial unity. This is, of course, from the popular point of view, the strongest argument which Professor Ripley has to meet. Speaking generally, one can always tell a Jew or Jewess by the

Jewish features and expression. So marked is this that Andrée mentions an instance where the negroes of the Gold Coast even distinguish between other whites and Jews by its means, saying not "Here are three whites coming," but "Here are two whites and a Jew." So marked a community of expression and appearance would be, to an ordinary mind, an absolute proof of unity of race, but Professor Ripley prefers to judge by the skull beneath, rather than by the expression and features on the surface. He hints at some obscure embryological process by which Jewish mothers can stamp on their offspring the Ghetto expression, whatever be the racial formation of skull. According to him, it would appear that noses are more plastic in this regard than skulls. I do not quite see how this would work out in detail. Are we to suppose that a pair of snub-nosed converts to Judaism would produce offspring with the characteristic Jewish nose because the lady convert had her imagination influenced by the hook-noses surrounding her? Are we to suppose that round heads can only beget round heads, but that snub noses can produce the hooked variety as a mere result of imagination?

Mere expression one could understand could be produced by sociological causes, and it is certainly my impression that Jews who mix more with their fellow-citizens lose a good deal of the characteristic Jewish expression, but that Jewish features should be influenced in this way few people would be prepared to allow. Jewish "nostrility," as I have termed it, and the "Jew's eye," can not be affected by change of environment. They can be affected, I grant, by admixture with races snub-nosed or dull-eyed, but as they have persisted throughout the ages they are themselves a striking proof of the absence of such admixture.

Altogether I remain unconvinced by Professor Ripley's arguments as to any large admixture of alien elements among contemporary Jews as unvouched for by history, and not necessarily postulated by anthropology. The broad skulls of the Jews, if they differ from those of earlier date (of which Professor Ripley has produced no evidence whatever), are due to the development of Jewish capacity, owing to their consistent attention to education and to the conditions under which they have pursued the struggle for existence. The persistence of Jewish features throughout the ages and the existence of an influential minority who are not allowed by Jewish law to marry outside their race is further proof of the position for which I have throughout contended. If there has been a tolerably large admixture of Jewish and alien blood throughout the Christian centuries it has been by conversions to Christianity or Islam, not by adoption of Judaism, and it is confirmed by history that the offspring have wandered away from the Jewish race and have not affected the more conservative remnant.

The significance of this result for the science of anthropology can not be overrated. The great question of the science is that expressed by Dr. Galton as "the struggle between Nature and nurture"—the difference that social influences can produce on men of the same race. Jews afford the science almost the sole instance in which this problem can be studied in its least complex form. My own investigations have shown that social environment has a direct influence on such anthropometrical data as height and breathing capacity. The Jews of the West End of London, though of the same race as those of the East End, are superior in height and other external qualities, and this superiority can thus be shown to be due entirely to nurture. Similarly, if the argument I have previously adduced is correct, the brachycephalism of the Jew is a proof that intellectual development produces broad heads, and that, roughly speaking, the cephalic index is a key to intellectual capacity. I should rather reverse Professor Ripley's main contentions: breadth of skull is not a criterion of race, but of intellectual development; whereas features, which are not directly influenced by social or intellectual characteristics, are the true index to racial purity.

SOME PRACTICAL PHASES OF MENTAL FATIGUE.

By Prof. M. V. O'SHEA.

I.

MODERN studies in neurology have contributed much to our knowledge of the function of the nervous system as a whole and of its several parts, and also of the relation of psychical activity to cerebral conditions and processes. The architecture of the neural mechanism delineated by these investigations is not only interesting in itself on account of the marvelous unity of things apparently diverse, but it is at the same time suggestive respecting its office as the physical instrument through which mind must express itself in this world. Psychologists now quite generally conceive of a living being, human or otherwise, as a reacting organism, receiving impressions from its environment and responding to them in some characteristic manner. To be fitted for this office an individual must be provided with appliances alike for the reception of stimulations and for their transformation into incitements to muscular activity. In the human species Nature has ordained that action need not follow immediately and inevitably upon any sense stimulus; fortunately, it may be deferred, so that when it does finally occur it will be the resultant of any given present impression modified by others previously received and treasured up in memory, as we say. To accomplish this really great feat, Nature had to devise an elaborate contrivance, interposed between incoming messages and outgoing impulses, to act as a moderator or transformer of a very extraordinary and intricate character—the central nervous system, comprising the brain and spinal cord. That it may be able to meet the requirements of its office, this system must be equipped with two principal kinds of apparatus—cells, which will serve as storehouses of energy to be employed in keeping the machinery running, and association fibers or pathways, which will put any one cell into communication with others in the cerebral community.

The item which will engage our attention principally here relates to the primary function of the nerve cell—to store up vital forces in the form of highly unstable chemical compounds,* which may upon slight disturbance be broken down, the static energy represented in their union thus becoming dynamic. Those who have given special attention to the matter seem to agree that all activity, physical as well as mental, involves the expenditure of a portion of this energy.† It may perhaps be mentioned in passing that when this conception was first being presented some persons hastily constructed the theory that what people had been calling mind was nothing more nor less than a certain mode of manifestation of this mysterious but yet physical force. While abundant evidence, gained from various sciences by recent research, leads one to the conviction that in some unknown manner psychical and neural processes are closely co-ordinated, yet not a single investigator of standing claims that they are identical. There is doubtless among some in our day too great a tendency, unconscious though it may be for the most part, to declare that a description of the physical correlates or antecedents of mental phenomena fully accounts for the latter in respect alike of their nature and their modes of manifestation; but those who find themselves coming to such conclusions might be both interested in and benefited by examining the opinions of great naturalists and psychologists who have reflected long and profoundly upon the world-old problem of the connections between body and mind—such men as Lotze,‡ Darwin,# Romanes,|| Wallace,^ Fiske,◊

* For chemical formulæ of some of the compounds, see Ladd, Outlines of Physiological Psychology, p. 13.

† For the opinions of investigators, as Mosso, Lombard, Maggiora, Kraeplin, and others, see Pedagogical Seminary, vol. ii, No. 1, pp. 13–17; Scripture, The New Psychology, chapter xvi; and Educational Review, vol. xv, pp. 246 *et seq.*

‡ Microcosmus, p. 162.

Descent of Man, p. 66.

|| Mental Evolution in Man, pp. 213 *et seq.*

^ Darwinism, p. 469.

◊ Destiny of Man in the Light of his Origin.

Drummond,* Wundt,† and many others of equal scientific attainments.

The architecture and chemical constitution of the neural elements indicate unmistakably, it seems, that they were so constructed that in their functioning they would be amenable to the law of the conservation of energy, and recent investigations have produced some experimental evidence in support of this view. Hodge,‡ who succeeded in making microscopical examinations of living nerve cells while under stimulation, demonstrated that the cell by this treatment was depleted of its contents, as revealed in the gradual reduction of its size. In corroboration of these results it was found that the cerebral cells in animals were larger in the morning than after a day's activities, indicating that depletion must have taken place during waking life, followed by recuperation in sleep. Some interesting data relating in a way to this matter are easily gained in the laboratories by the use of the plethysmograph, which is designed to record the degree of blood pressure in different parts of the body. This instrument may be put upon the wrists and head, for instance, and it may be observed, when a person is subjected to certain influences whether, there is any alteration in blood supply in either region. It may be noticed, as a matter of fact, that when one is required to think diligently upon any problem, or being asleep is awakened or even disturbed by a noise in his environment, the volume of blood decreases in the wrist and increases in the head.[#] This same phenomenon is shown by experiments with the scientific cradle.‖ The inference from these data seems reasonable, that mental activity causes an expenditure of nerve force, which Nature seeks to replenish by inciting an unusual flow of nutritive-bearing fluid to the cerebral cortex. It has been shown, in further illustration of this law, that thought increases the temperature of the head, indicating that heat is generated through molecular activity; and also that psychical action increases waste products in the system, which may be derived only from the degradation of substances in nerve cells.[^] So information obtained from various other sources points toward the conclusion that in all activity energy stored in nerve cells is dissipated.

Recent experimental studies have given us reasons for believing that nerve cells in different individuals yield up their energy in response to stimulation with varying degrees of readiness.◊ Ex-

* Ascent of Man. † Human and Animal Psychology, pp. 5–7 and 440–445.

‡ For a complete statement of methods and results, see Hodge, American Journal of Psychology, vol. ii, pp. 3 *et seq.*; and vol. iii, pp. 530 *et seq.*

[#] See Pedagogical Seminary, vol. ii, pp. 12 *et seq.* ‖ Ibid., *op. cit.*

[^] Cowles, Neurasthenia and its Mental Symptoms, pp. 17 *et seq.*

◊ Educational Review, *op. cit.*

perience corroborates what Professor Bryan * has said: that some persons possess a leaky nervous system, wherefrom their vitalities flow away without issue in useful results. In such individuals activity will be likely to be in excess of that which the stimulus occasioning it should normally produce. Every one must have seen children, and adults as well, who when they hear a slight noise, for instance, which others do not mind, react with great vigor by jumping or screaming; or, when spoken to unexpectedly the face flushes, the lip quivers, and they become physically uncontrolled in a measure. In these instances the persons are unduly profligate in the expenditure of their means, and, in consequence, their capital is relatively soon exhausted.†

The writer last year conducted some experiments upon school children which yielded results that appear to confirm the view here set forth. Scripture's steadiness gauge was used in one test. This is designed to investigate stability of control by requiring a person to direct a light rod under guidance of the eye upon a point several feet distant, failure to accomplish this being announced by the ringing of an electric bell. The subject is usually required to make the trial fifteen times at a single test, and the number of successful attempts is taken to be in a way, although not always reliable, an index to his power of co-ordination. But more important than the success or failure in accomplishing the task is the index it affords of the nervous condition of the subject as revealed in the expressions of face and body. Tests were made in the morning, shortly following the opening of school, and again at half past eleven o'clock, or thereabouts, after the pupils had been working over their lessons for about two hours. One boy of eleven years, A. M., is a fair illustration of what might not inappropriately be called an exhaustive type, wherein nervous energy is readily depleted because of incessant waste. In the morning tests he was well controlled and accurate. A record of five tests made at half past eleven all show that after four or five attempts to place the rod upon the point the hand became very unsteady, the lips compressed, the region about the eyes showed unusual constraint, and the hand not being used was tightly clinched. Ten trials were usually sufficient to produce twitchings or *tics* in the face and body, although nothing of this was ever noticed at other times. This boy invariably made hard work of the task, and all the physical accompaniments indicated excessive motor stimulation following, of course, upon an unduly excited condition of the cerebral cells. At the close of the experiments he generally seemed exhausted, and upon three occasions

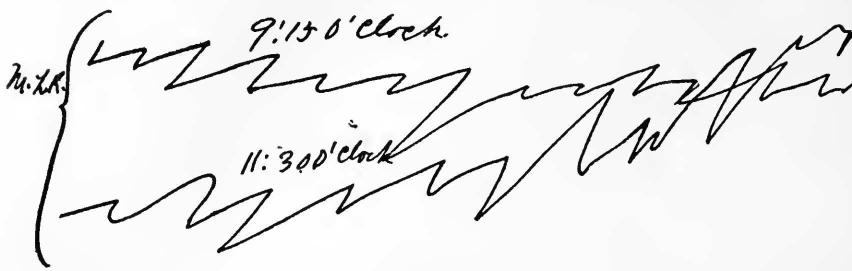
* Addresses and Proceedings of the National Educational Association, 1897, p. 279.

† *Cf.* Warner, The Study of Children, chapters viii and ix.

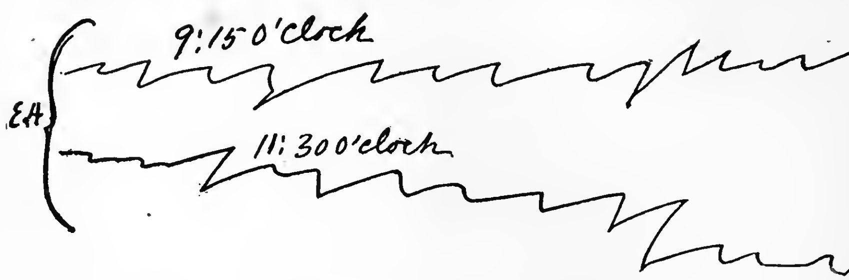
it was thought best not to permit him to make the entire fifteen trials.

Another pupil, W. R., two years younger, illustrates a different type. In the morning trials he was no better than A. M., but he, too, was subjected to five different tests at half past eleven, with the result that he could in every instance complete the task without any apparent fatigue. There was no constraint apparent in the face or hands, no unusual effort to co-ordinate the muscles of the body, and no twitchings of any kind. Now, it seems probable that in the case of W. R. the brain was able to adjust effort in right degree to the needs of the occasion, while with A. M. there was such prodigality in the expenditure of energy in various irrelevant motor tensions and activities that it not only defeated its purpose, but it was soon largely spent. A. M. showed this tendency to nervous extravagance in all the work of the school. While an unusually bright boy, he yet became fatigued in the performance of duties that W. R. could discharge with no evidence of overstrain; indeed, the latter boy seemed never to reach a point beyond which he could not go with safety if he chose.

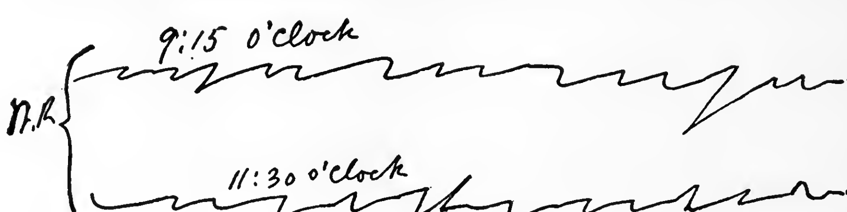
Further illustrations of this principle of individual differences in the conservation of nervous energy were afforded by another simple experiment. The apparatus employed consisted of a plate of smoked glass set in a frame so that it could be moved horizontally. Just touching the glass, and adjusted to it by a delicate spring, was a fine metal point which could be maintained at any height by a silk thread to be held in the fingers of the subject to be experimented upon, who stood with closed eyes endeavoring to keep his hand perfectly quiet for one half minute. During the test the glass was moved slowly in the frame, the metal point thus tracing a line which was a faithful index to most of the movements, at any rate, of the subject's hand. Five sets of experiments were made upon a number of pupils in the morning soon after the opening of school, and again just before the noon recess. The accompanying tracings are reproductions of those gained at one of the tests, and are typical examples. The first two were secured from a girl, M. L. R., eleven years of age. The one made at half past eleven, after two and a quarter hours' work in school, shows a significant phenomenon which could be easily witnessed during the experiment. She had become so fatigued that all muscular expressions were unusually constrained. During the short period while the experiment continued one could observe the arm and fingers contracting, which accounts for the upward direction of the tracing. The body swayed almost to the point of falling, the fingers of the hand not employed were clinched, and all the expressions indicated great tension. The second set of tracings, gained from a girl, E. H., twelve years of age, shows evidences of marked fatigue after a few hours' work; but the effect upon the bodily activities is quite in contrast with that of the case just mentioned. Here there was relaxation of the mus-



cles, a general letting go of the whole body, revealed in the tracings taking an abrupt downward direction. The third group of tracings was gained from W. R., whose characteristics have already been adverted to, and who indicated here, as in the other tests, that his morning's duties had had no serious effect upon his nervous energies.



It should be said in passing that the principle of healthful mental growth and activity seems to require that in education of any sort cerebral cells should be freely exercised up to the point of fatigue, but never beyond; for after this there is not only no progress, but what has been gained by previous training may even be lost. And, what is more serious, the undue depletion of the nerve cell renders



its recovery extremely slow, and investigation has shown that school children when overtaxed return to their studies day after day in a fatigued condition, their energies not being fully restored until the long vacation brings the needed rest.* Those who train athletes realize that the fatigue limit must not be passed if possible, and this law is recognized as well in the training of racing horses.† One who has observed his experience in learning to ride the bicycle must have discovered that practice pursued when in a condition of exhaustion operates rather to retard than to promote facility. So in matters of the mind activity carried to excess, which point is further removed in some cases than in others, results in retardation of growth, even though no more serious consequences ensue.

II.

As might be readily inferred, even if we were lacking xperimental evidence, fatigue interferes with the normal activities alike of body and mind. One of the earliest and most conspicuous effects may be observed by any one in the people about him—a decrease in the rapidity of physical action. The child depleted of nervous energy, for whatever reason, will usually be slower than his fellows in performing the various activities of home or school. If observed during gymnastic exercises it may be noticed that his execution of the various commands is delayed; in responding to signals he is behind his comrades whose nervous capital is not so largely spent. And what is here said of the child is, of course, equally true in principle of the adult; the effect of fatigue in his case will be revealed in less lively, vivacious, and vigorous conduct in the affairs of business or of society. Mosso,‡ Burgerstein,# Scripture,|| Bryan,^ and others have been able to confirm by scientific experiment what people have thus long been conscious of in a way—that cerebral fatigue renders one slower, more lethargic in his activities. It seems clear, to hazard an explanation, that when nerve cells become depleted up to the point of fatigue Nature designs that they should be released from service in order that repair may take place. This rhythm of action and repose seems to be common to all forms of life. The phenomenon of sleep is an expression of this principle, and is characterized by almost entire absence of activity.

Again, fatigue disturbs the power of accurate and sustained bodily co-ordinations, particularly of the peripheral muscles, or those engaged in the control of the more delicate movements of the body, as of the fingers. Every one must have had the experience that consequent upon a period of exacting labor (physical or mental), or

* Educational Review, *op. cit.*

† Bryan, Addresses and Proceedings of the National Educational Association, 1897.

‡ Pedagogical Seminary, vol. ii, pp. 20 *et seq.*

Ibid., *op. cit.*

|| The New Psychology, pp. 128–132.

^ The Development of Voluntary Motor Ability, p. 76.

worry, the hand becomes unsteady, as revealed in writing or other fine work, the voice is not so perfectly controlled as at other times, and perhaps involuntary twitchings or *tics* make their appearance in the face or elsewhere. Ordinarily people regard these phenomena as evidences simply of "nervousness," but, as commonly used, this term does not take account of the neural conditions responsible for these abnormal manifestations. Warner * points out that nerve cells in a state of fatigue become impulsive or spasmodic in their action; there is not such perfect balance as usually exists between them when in a normal, rested condition, and this results in lessened power of inhibition. Scripture † and others have shown by experiments in the laboratory that fatigue renders co-ordination less sustained and accurate. If, now, one observes a group of people, young or old, in which some or all have passed the fatigue limit, he can see the cause of many of those occurrences which give the teacher in the school, for example, continual trouble. The children will doubtless be moving incessantly in their seats, books and pencils may be dropping upon the floor, and various signals are responded to slowly and in a disorderly manner. The restlessness is probably due for the most part to the effort of the pupils to relieve the tension of muscles induced by overstrain, while inability to accurately co-ordinate the muscles employed in holding pencils and books causes objects to slip out of the pupils' hands upon the floor. One has but to observe his own experience, and he will soon realize that when nervously exhausted he is not so certain of retaining securely small objects which he handles. This accounts for what is sometimes regarded as carelessness in school children as well as in adults, exhibited in slovenly writing, in breaking dishes, and in similar occurrences. Any task demanding delicate and sustained adjustment of the finer muscles on the part of one fatigued will be liable to be performed in a careless manner, as we are apt to feel. Often more than not the term carelessness probably denotes impaired neural conditions, as well as consequent mental dispersion, if one may so speak, leading to inaccurate and intermittent mental and physical adjustments to duties in hand.

Cowles ‡ observes that the first prominent and serious mental concomitant of nervous depletion is revealed in the inability to direct the attention continuously upon any given subject; and James has said that when one is fatigued the mind wanders in various directions, snatching at everything which promises relief from the object of immediate attention. Experiments in the laboratory upon the keenness of sense discrimination of data appealing to sight, hearing,

* Mental Faculty, pp. 76, 77.

† The New Psychology, pp. 236–248.

‡ *Op. cit.*, p. 47.

touch, and the other senses, show that there is lessened ability in conditions of fatigue; * and this is accounted for probably by the waning power of attention. The mind can be held to one thing, excluding irrelevant matters. This phenomenon is further illustrated in the following simple experiment: The pupils in a large graded school in Buffalo, N. Y., were required upon three successive days, at half past nine o'clock and again at half past eleven in the morning, to trisect a line three inches long. The results, calculated for one hundred and fifty children, show that on the average they were several millimetres nearer correct in the morning trisections than in those just before the midday recess.† It seems that this test measured the degree of attention which pupils were able to exert at different hours during the day, and it confirmed what must in a way be known to every one—that a day's work in school reduces the energy of attention. Doubtless every instructor has remarked how much more difficult it is at half past eleven than at ten to hold the thoughts of students to the subject in hand, and if recitations in intricate studies occur late in the forenoon, progress will be slower and more errors will be made, simply because pupils are unable to attend so critically.

The significance of this latter effect of fatigue must be apparent when it is realized that attention is at the basis of all the intellectual processes. If one can not attend vitally, he can not perceive readily or accurately; he will be unable to recall fully or speedily what has formerly been thoroughly mastered; and, most serious of all, he can not so well compare objects or ideas to discover their relationships—that is, he is not so ready or accurate in reason. In fatigue, then, one really becomes stupid. Suppose a fatigued pupil in school working over his spelling lesson, for instance; he will be liable to make errors both in copying from the board and in reproducing what he already knows. In recitations in history, memory will be halting; what has apparently been made secure some time before now seems to be out of reach. In those studies requiring reflection, as arithmetic, grammar, geography, and the like, the reasoner will be unable to hold his thoughts continuously to the matters under consideration, and so will be unable to detect relationships between them readily and accurately. When one considers, in view of what is here set forth, that many persons, adults as well as students, are for one cause or another in a constant

* See Educational Review, *op. cit.*; Galton, Journal of the Anthropological Institute, 1888, pp. 153 *et seq.*

† Since this article was written extensive investigations on school-room fatigue have been made in the schools of Madison, Wis., under the writer's direction, and the general principles here mentioned have been corroborated.

state of fatigue, he can see the explanation of the stupid type of individual, in some instances at any rate.

The effects upon the emotional activities, while not so easily detected by experimentation, may yet be readily observed in one's own experiences and in the conduct of persons in his environment. Cowles,* Beard,† and others assure us as physicians that neurasthenia gives rise to irritability, gloominess, despondency, and sets free a brood of fears and other kindred more or less abnormal feelings. Wey,‡ in his studies upon the physical condition of young criminals, has found that in the majority of instances there appears to be some neural defect or deficiency, mostly of the nature of depletion, which he believes contributes to alienate the moral feelings of the individual. There is little doubt that viciousness has a physiological basis. It is probable that in such a case the highest cerebral regions, through which are transmitted the spiritual activities last developed in the race, becoming incapacitated first by fatigue, are rendered incapable of inhibiting impulses from the lower regions, which manifest themselves in an antisocial way.

III.

It follows from what has gone before that cerebral fatigue is a most important matter to be reckoned with in all the affairs of life, but especially in education, where the foundations for nervous vigor or weakness are being permanently established, and where relatively little can be accomplished in either intellectual or moral training unless the physical instrument of mind be kept in good repair. It needs no argument to beget the conviction that we should if possible ascertain what circumstances produce fatigue most frequently in the schoolroom, so that they may be ameliorated and their injurious consequences thus avoided. What, then, are the most important causes? It is well to appreciate at the outset that every individual has a certain amount of nervous capital which, when expended, leaves him a bankrupt, and it is of supreme import to him that something should always be kept on the credit side of his account. If we would deal most wisely with a pupil, then, whose activities we are able to direct, we should know just what demands we could make upon his energies without fatiguing him. But we can not hope at the present time and under present conditions to discover with accuracy the fatigue point of each individual, and even if we were able to do so, we would doubtless find it next to impossible to observe it at all times in our teaching, espe-

* *Op. cit.*, pp. 47 *et seq.* † *Op. cit.*, pp. 36–117.

‡ Papers in Penology, 1891, pp. 57–69; *cf.* Collin, also in same, pp. 27, 28; Wright, American Journal of Neurology and Psychiatry, vols. ii and iii, pp. 135 *et seq.*

cially in our large graded schools. But we can at any rate adjust our requirements with some degree of accuracy to the average capacity of the whole.

Regarding the number of hours of mental application per day which may be safely expected of a pupil in school, investigations have tended to show that there is a danger of requiring too many. When pupils return to school morning after morning without having recovered from the previous day's labors, it is evident that too heavy draughts are being made upon their nervous capital. It may be said in reply that many factors conspire to produce this depleted condition, as insufficient sleep, inadequate nutrition, and outside duties; but the answer is that under such unfavorable circumstances less work may be demanded. As the curriculum is planned in many places, alike in graded and ungraded schools, the pupil is expected to be employed in the school for five or six hours a day no matter what may be his age, and to this work should be added studies at home for the older students. Now, as Kraeplin * has justly observed, Nature ordains that a young child should not give six hours' daily concentrated attention in the schoolroom, but, rather, she has taken pains to implant deeply within him a profound instinct to preserve his mental health by refusing to attend to hard work for such a long period. Consequently, in such an educational *régime*, the mind of the pupil continually wanders from the duties in hand. The most serious aspect of this is apparent, that when attention is constantly demanded and not given, or when a pupil is pretending or attempting to keep his thoughts turned in a given direction, yet allows them to drift aimlessly because he is practically unable to control them, he is acquiring an unfortunate habit of mental dissipation. It seems certain that healthful and efficient mental activity requires that a child apply himself in a maximum degree for a relatively short period, the duration differing with the age of the individual and the balance of nervous energy to his credit; and then he should relax, attention being released for a time.

Experiments conducted by Burgerstein † and at Leland Stanford Junior University ‡ emphasize a particular phase of this principle—that too long continued mental application without relaxation induces fatigue more readily than when there are comparatively short periods of effort, followed by intermissions of rest. Thus when pupils (and the younger they are the more is this true) have a given amount of work to do requiring their attention say for an hour and a half they will accomplish most with least waste of energy by breaking up this long stretch into several parts, interspersing a few min-

* A Measure of Mental Capacity, Popular Science Monthly, vol. xlix, p. 758.

† *Op. cit.* ‡ Pedagogical Seminary, vol. iii, pp. 213 *et seq.*

utes of free play. With adults application may profitably continue for longer periods, but even here the rhythm of concentration and relaxation must be observed in order that effort may have the most fruitful issue. There would assuredly be less dullness, carelessness, and disorder in our schools, high and low, and in our homes, if this law were observed in the arrangement of the activities of daily life. The writer knows of a normal school where the work begins at half past eight in the morning and continues until one o'clock, with a pause of only ten minutes in the middle of the session. During the passage of classes from room to room at the close of recitations, monitors are placed in the halls to prevent any exhibition of freedom in communicating with one another or in the movements of the body. Here there is little if any relief to the attention, since pupils are under practically the same constraint as when reciting in Latin, Greek, or geometry. This enthronement of discipline, which we all seem natively to think necessary that we may prevent the reversionary tendencies of youth, is sure to breed in some measure the very maladies—stupidity and disorder—which various agencies in society are striving to cure by all sorts of formulæ.

In the normal, well-organized adult brain the various areas are closely knit together by association pathways or fibers,* which renders it possible to employ in particular direction the energies generated over large regions. But this development comes relatively late and is not fully completed under about thirty-three years of age, it is now believed. It is in a measure, then, impossible for the young child to utilize the energies produced in one part of the brain in activities involving remote sections. One who observes little children in their spontaneous activities can not fail to note evidences in plenty in illustration of this principle. It should be apparent, then, why a school programme so arranged that a lesson in writing is followed by one in written language, this by written number, and this in turn by written spelling, or possibly by a written reproduction of a lesson in Nature or literature, is admirably suited to exhaust the overused areas of pupils' brains, whereupon the mental and physical effects of fatigue make their appearance. In one of the large cities of our country the amount of time spent in writing was calculated for all the grades in the schools, and it was found that at least one hour was required of the children in every grade, and in the fourth and fifth grades they were engaged for two hundred minutes every day in writing in some form or other.

* Donaldson, The Growth of the Brain, chapters ix to xiii.

Doubtless every one has observed how readily he becomes fatigued when he is engaged in activities demanding very delicate muscular adjustments—threading a needle, for instance. Work of this character involves particularly the higher co-ordinating areas of the brain, those controlling the more precise and elaborate adjustments of the body, and this work makes large demands upon one's nervous energy. This seems to be pre-eminently true of the child, in whose brain the highest regions are yet comparatively undeveloped, so that much exercise of them leads quickly to exhaustion. Those activities, then, which compel a great amount of exact co-ordination of young children will easily fatigue them. The writer has for some time been observing the effect of various sorts of playthings upon the activities, particularly upon the emotions, of two young children. He has noticed that those plays requiring most accurate co-ordination, as stringing kindergarten beads with small openings or writing with a hard lead pencil, will quickly produce fatigue, shown in irritability, discontent, and lack of control; while those plays which employ the larger muscles, as working in sand or drawing a cart, are more enduring in their interest and are not attended by such disagreeable after effects. It is customary, however, in many homes and schools to require of the youngest children the finest work in the management of the smallest tools and materials, such, for instance, as writing on very narrow spaced paper, greater freedom being permitted in this respect as the pupil grows older—an inversion of the natural order. The mode of development of the nervous system indicates unmistakably that in all training the individual should proceed gradually from the acquirement of *strength* and *force* in large, coarse, and relatively inexact movements to the acquisition of *skill* in precisely co-ordinated activities.

Any reference to the remediable casues of mental fatigue would be incomplete without allusion to the harmful influence of certain personal characteristics in the people with whom we associate. By virtue of a great law of our being, that of suggestion, the importance of which we are appreciating more fully from day to day, we tend ever to reproduce within ourselves the activities of the things in our environment.* Now, when we are forced to remain in the presence of one fatigued, as pupils too frequently are in the school and children in the home, and this fatigue manifests itself in irritability, impatience, tension of voice, and constraint of face and body—in such an environment we become overstimulated ourselves and rapidly waste our energies. Especially true is this of children, who are more suggestible than adults; and, in view of this, one can ap-

* *Cf.* Sidis, The Psychology of Suggestion; and Vernon Lee and C. A. Thompson, Beauty and Ugliness, Contemporary Review, vol. lxxii, pp. 544–569 and 669–688.

preciate the necessity of placing in our schoolrooms, and if we could in our homes, persons possessing an endowment of nervous energy adequate for the demands to be made upon it without inducing too readily fatigue with all its train of evils.

BEST METHODS OF TAXATION.

By the Late Hon. DAVID A. WELLS.

PART II.

IN passing from the tariff, or duties on imports, to the internal or excise taxes imposed by the Federal Government, there is evidently a distinct change in purpose. However subject to abuse the tax on distilled spirits has proved, and however frequently its agency has been invoked to exaggerate the profits of interested parties, there has never been an open and avowed intention of turning it to private gain. The policy that has become almost inseparable from the customs tariff, and is by most people regarded as inherent in all customs legislation, has not been transferred to the internal revenue taxes save in one or two instances of recent application and secondary importance. The danger of permitting taxation to be employed by either State or Federal Government for a purpose other than that of raising necessary revenue has been dwelt upon. When a police power is exercised in conjunction with a tax framed for revenue, and is regarded as the more important function to be performed, the policy requires careful examination. If revenue is the real object, the method of imposing the tax and the determination of the rate which will give the highest return with the least interference in the production, distribution, and export of the commodity taxed remains to be defined. If restriction in manufacture, sale, or consumption is intended, the question is no longer one of taxation proper, but of police regulation. The Federal taxes on oleomargarine, filled cheese, and mixed flour are of the nature of police inspection, and the tax on the circulation of State banks, amounting, as it has, to prohibition, is a still more extreme exercise of the same power. The imposition and collection of these duties have a penal quality, an intention to restrict or prohibit the production or sale or use of some article. They are not properly taxes; they are not a proper application of tax principles, but have originated, in private interest, or in the deliberate intention to constitute a monopoly, State or other.

The approach of war, or its actual presence, is made the excuse of an extension of taxes, and the Federal Government tacitly admits its inability to increase indirect taxes on consumption by its general resort to an extension of the internal taxes and excise. The instrumentalities of business offer a fair field for stamp taxes, and these, when not so burdensome as to invite evasion, are acceptable because of the ease with which they are assessed and collected. A specific duty on the more important acts of commerce and daily business may be evaded, it is true, but not when the paper or instrument taxed must become public evidence. Stamps of small denomination on bonds, debentures, or certificates of stock and of indebtedness; on a bill of sale or memorandum to sell; on bank checks, drafts, or certificates of deposit; bills of exchange, draft, or promissory note; money orders and bills of lading; on express and freight receipts, on telegraph messages, and a large number of legal and other instruments, such as leases, mortgages, charter party, insurance policies—these are simple duties, productive of large returns, and not unequal in their weight. The law of 1898 included such stamp taxes, as well as others on proprietary articles and wines. It was not simple to predict the incidence of these rates, and the distribution has been unequal. The charges of one cent on telegraph messages and express packages are paid by the sender in the larger number of cases, the companies merely adding a penny to their rates. This was not the intention of the law, and the courts have held that it was not so intended. The individual is powerless in a few transactions, and only the great concerns are able to avail themselves of this decision. The duties for seats or berths in a parlor car or for proprietary medicines, are paid by the company or manufacturer, though in certain preparations the price to the consumer was advanced on the passage of the act. With all their drawbacks, and they are not few in number, these stamp duties afford a ready means of obtaining a good revenue without increasing unduly the general burdens of taxation. The law of 1898 was modeled after that of 1863, and many of the rates and descriptions will undoubtedly be incorporated into the permanent internal revenue system of the country—a measure enforced by the remarkably unequal returns derived from the customs.

The existing system of internal duties is even more defensible than the tariff as a source of revenue. Its inequalities, due to the haste in which the measure was prepared and the inexperience of those who framed the provisions and fixed upon the rates, are worn away in use, and where the rates are moderate and are not infected with a penal quality, the community adapts itself to them, accepting them as a necessary convenience. In the United States this spirit of acquiescence is most marked, not only because of a natural patience of tax burdens, but because of as natural a fear of other untried and more radical or oppressive measures. The situation of "business" when a general tariff bill is pending in Congress is one almost of panic, and the scramble to protect interests or to obtain some special advantage against rivals has become a scandalous feature of tariff revision. Except in the instances named, as oleomargarine and filled cheese, the internal revenue system presents less of a field for such an exhibition of greed and self-interest; but the spirit duties, and even the tobacco rates, may be used in such a way as to favor the large manufacturer against the small concerns, and are to that extent misused and applied for purposes antagonistic to those properly pertaining to taxation. In a time of tax revision the suggestions for new taxes and ideas for changing the old are freely offered, and do not stop short of absolute prohibition of an industry, of total destruction of interest. The vagaries of a legislative body under such suggestions have instilled into the public mind a wholesome fear of its possible acts and fully explain the timid and uneasy condition of "business" when a general tax measure is under discussion. Whether it be the manufacturer or producer seeking protective duties, or the Granger or Populist asking for taxes of confiscation against capital and accumulated property, the spirit is the same—a desire to turn taxation to improper purposes.

The tendency of Federal taxation to turn to taxes on capital and the instruments of "business"—direct, rather than indirect taxes—found its most extreme illustration in the income tax of 1894, the principles of which have already been discussed. It finds a more moderate and restricted exercise in certain graduated duties under the act of 1898, and especially in the duties on legacies and distributive shares of personal property. It was no sentimental or even theoretical argument based upon the right of inheritance or the inequality of taxation that led to the adoption of these duties in 1898; it was only a blind following of the provisions of the earlier act, and the consciousness that revenue must be had at every cost, and no possible source of income should be overlooked. Yet the legacy tax is essentially a tax of democracy and defensible for much the same reasons as a tax, whether graduated or not, upon income might be.

By the act approved June 13, 1898, entitled "An act to provide ways and means to meet war expenditures, and for other purposes," the national Government imposed a tax upon legacies and distributive shares of personal property. This tax has been one of the features of the tax law of 1862 (§§ 111–114), but in a much simpler form and in a form better calculated to produce a revenue. This earlier law imposed a duty on all legacies exceeding one thousand dollars in amount, but very properly made a distinction in the rate according to the degree of connection between the person from whom the property came and the receiver of the legacy. Thus, lineal issue or lineal ancestor, brother or sister, should pay at the rate of seventy-five cents for each and every hundred dollars of the clear value of the interest in the property. A descendant of a brother or sister of the decedent paid double this rate; an uncle or an aunt was taxed three dollars for every one hundred dollars passing; a great-uncle or a great-aunt, four dollars; and persons in any other degree of collateral consanguinity, or a stranger, or a body politic or corporate, five dollars. The only exemption made was in favor of a wife or husband. As only personal property was intended to be reached, all land and real estate escaped the duty.

The law of 1898 made important modifications in these rates and manner of assessing. In the first place, the rates fell only on legacies in excess of $10,000, a limit ten times larger than that of the law of 1862. The degrees of relationship were the same, the rates were copied from those of the earlier act, and the same exemption of property passing between husband and wife was admitted. But the idea of a progressive tax was ingrafted into the law. Thus, the old rates applied only to legacies of more than $10,000 and not more than $25,000. When the property passing was valued between $25,000 and $100,000 the rates were multiplied by one and a half; between $100,000 and $500,000, they were multiplied by two; between $500,000 and $1,000,000, they were multiplied by two and a half; and by three when the property was in excess of $1,000,000. In restricting the tax to personal property passing by inheritance the measure aims at a crude means of making the burdens of personal more nearly approach those of real property. No such consideration controlled the views of those responsible for the act, and, after all, it offers only a question of theoretical interest. The inheritance tax collected in many of the States may have owed their adoption to such an idea, but the United States, in taking up these duties, merely saw a means of obtaining revenue without regarding the actual results of the tax on the estates paying it.

"The inheritance tax in one form or another has come to stay, and new States are being added every year to the list of those which have adopted it. Five years ago it was found in only nine States of the Union—Pennsylvania, Maryland, Delaware, New York, West Virginia, Connecticut, Massachusetts, Tennessee, and New Jersey. During the first half of 1893 Ohio, Maine, California, and Michigan were added to the list, though the Michigan law was afterward annulled because of an unusual provision in the State Constitution which was not complied with. In 1894 Louisiana revived her former tax on foreign heirs; Minnesota adopted a constitutional amendment permitting a progressive inheritance tax which has not yet been given effect by the Legislature; and Ohio added to her collateral inheritance tax a progressive tax on direct successions. In 1895 progressive inheritance taxes were adopted in Illinois and Missouri, and an old proportional tax was revived in Virginia; and last year Iowa adopted in part the inheritance tax recommendation of her revenue commission." *

The real problems are to be encountered in local taxation. The many different methods used in the different States, the want of uniformity in the local divisions of each State, and the extraordinary diversity in the interpretation or application of tax laws by the courts and executive authorities of the States have introduced a confusion, to end which, many would invoke the intervention of the Federal Government. The haphazard manner in which the laws have been framed and passed is only the least notable explanation of the variety of phrase and interpretation to be found. Even were the Federal Government to establish definitions, and frame rules of uniform assessment, there would still be room for difference. The customs tariff is known to be variously applied in the different ports of the country, and there is greater certainty in the tariff rate than could be found in a tax resting on the assessed valuation of land, for example.

The difficulty encountered by France in its attempt to determine the net income from land for the purposes of taxation carries an important lesson. Failing to obtain uniformity of appraisement of this net income under the crude method first employed—of basing it on the character of soil and nature of cultivation, deducting the expenses of cultivation—a *cadastre* was decreed.† In this *cadastre* each particular piece of property was recorded, with its boundaries, its manner of cultivation, and its net rental. Begun in 1807, it was not completed until 1850, and proved of little value, as no provision had been made for recording the changes in cultivation, rentals, or other conditions, except those of ownership, buildings, and exemption from taxes. Instead of proving a successful means to a desired end, it "turned out to be a stupendous disillusionment." "The experience of both the western Prussian provinces and of France showed that the newly constructed *cadastre* was of considerable service in equalizing the land tax within a relatively small area, but not as a basis for alterations in the contingents to be paid by large and widely separated regions. The officials in charge of the *cadastre* on

* Max West, in North American Review, May, 1897, p. 635.

† The word *cadastre* was derived from the Latin *capitastrum*, or register of *capita*, *griga*, or units of territorial taxation into which the Roman provinces were divided for the purposes of *capitatio terrena*, or land tax. It is of modern use and is locally found in Louisiana.

the Rhine, as well as those in France, themselves admitted that any computation of net income was uncertain; that the coincidence of the figures obtained by the cadastral computation with the actual net income could never be assured; that the figures afforded by the *cadastre* were rather of the nature of a proportion, while uniformity of assessment was to be attained rather by observation of the business transacted than by depending on the figures obtained by computation." * This effort to discover and record the net income from land was a failure.

So thorough an experiment, carried through so long a time, and presenting an example to be avoided, was in fact imitated by Prussia under a law of 1865. In each division (*Kreis*) was appointed a commissioner, who was chairman of a committee, the size of which ranged from four to ten members, according to the size of the division. One half of this committee was appointed by the representatives of the division and one half by the central Government. A number of divisions formed a department, with its commissioner and committee of similar composition as in the division, and above all was a central committee, presided over by the Minister of Finance. The valuation was accomplished in less than four years. The method was applied only to land employed in agriculture or forests; a separate law provided for the taxation of buildings and gardens. In the end the results were no better than those obtained in France. In either case a plan too refined to work to advantage had been employed, and, apart from its simplest function, that of making a general survey of the land and the uses to which it was applied, it could not advance the theory of a proper land tax. No modification could make it a better instrument of taxation. The gross income from land as a taxing basis would involve heavy injustice, and further supervision by government officers could not do away with the mechanical difficulties of securing uniformity. The English plan of making rental value the foundation is more easily applied and gives better results.

If land be difficult of assessment, personal property offers a very much more difficult problem. On this particular question this country has much to learn from the experience of other governments. In Great Britain a Royal Commission has been making a study of local taxation, and, in a preliminary report, concludes that an alteration in the law for the purpose of obtaining a uniform basis of valuation in England and Wales is a necessary preliminary to any revision of the existing system of local taxation. It has been already stated that the poor rate constituted the basis of valuation of property for local rates. In its development the system has become

* Cohn, Science of Finance, p. 477.

more complicated. Two valuations of the same property may be made for raising imperial taxes—namely, one for the income tax, and one for the land tax. Three valuations of the same property may be made for raising local rates—namely, one for the poor rate, one for the county rate, and one for the borough rate. Here, then, are five different valuations in activity.

Of these the parish was the first and most important division, having been introduced in the sixteenth century, when the dissolution of the monasteries had raised the question of poor relief. It was adopted for convenience, as the contributions were at first entirely voluntary; but as the problem of the poor increased in importance, compulsion was applied, and at the beginning of the seventeenth century, by the acts of Elizabeth of 1597 and 1601, compulsion was fully established and the parish adopted as the area for levying rates for the relief of its poor. It now became necessary to define more specifically the persons liable for this rate, but the law framed no system by which assessments were to be made or rates collected. A distinction was made between the occupier of certain properties (such as lands, houses, coal mines, or salable underwoods) and an inhabitant of the parish. The occupier was to be taxed upon the basis of the annual benefit arising from the property situated in the parish; but the inhabitant was taxed not in respect to any specified subjects, implying an intention to tax them upon some other basis. This raised the question of "ability," and how that question was to be determined. The act said nothing that could point to personal property, "and it was only on the ground of his being an inhabitant that any owner of personal property could be rated for that property, because there was no word in that statute to include him, except the word inhabitant. Under that statute, therefore, there was necessarily a distinction between residents and nonresidents, because the resident would be ratable for his personalty within the place, the nonresident not. The distinction, however, under that statute applied only to those kinds of property which the statute did not specify, for the occupier of lands, houses, etc., and whatever the statute enumerated, was ratable whether he were resident or not." * And when the judge of assize was asked to give an opinion he decided that lands should be taxed equally and indifferently, but an additional tax could be laid on the "personal visible ability" of the parishioner. Further, "all things which are real, and a yearly revenue must be taxed to the poor." Yet there were limitations on this apparently wide interpretation, and as early as 1633 it was only visible properties, both real and personal, of the inhabitants within the parish, and only within the parish, that could

* Abbott (Chief Justice) in R. *vs.* The Hull Dock Company, 3 B and C, p. 525.

be taxed. The property to be assessed must be local, visible, and productive; it must consist only of the surplus left after deducting debts; it must be rated according to the profit produced; and its nature must be distinctly specified. "Consequently, such subjects as wages, pensions, easements, profits derived from labor and talent, profits from money invested or lent elsewhere, and furniture, were exempt."

The absence of all attempts to tax or value property other than what was visible and tangible continued to the reign of Queen Anne, when a single decision of the court pointed to the taxation of the stock in trade of a tradesman, a decision that does not appear to have been acted upon. As late as 1775 Lord Mansfield said, "In general, I believe neither here nor in any other part of the kingdom is personal property taxed to the poor." At all events, it could not be taxed unless usage could support it. Toward the end of the century, when taxation for the Napoleonic wars was touching more intimately the concerns of the people, the idea of subjecting personal property to the poor rate was favored, but nearly half a century passed before it attracted attention. In their report for 1843 on local taxation the poor-law commissioners gave the following summary of the status of this question:

"The practice of rating stock in trade never prevailed in the greater part of England and Wales. It was, with comparatively few exceptions, confined to the old clothing districts of the south and west of England. It gained ground just as the stock of the wool staplers and clothiers increased, so as to make it an object with the farmers and other rate payers, who still constituted a majority in their parishes, to bring so considerable a property within the rate. They succeeded by degrees, and there followed upon their success a more improvident practice in giving relief than had ever prevailed before in England. . . . When the practice of rating stock in trade was fully established in this district, the ancient staple trade rapidly declined there and withdrew itself still more rapidly into the northern clothing districts, where no such burden was ever cast upon the trade."

A final determination of the question was imposed upon Parliament by the pressure of the manufacturing and commercial classes arising from a decision in the case of R. *vs.* Lumsdaine, in 1839, looking to the taxation of personal property. In consequence, an act was passed (3 and 4 Vict., c. 89), and has remained in force until the present time, exempting an inhabitant from any tax "in respect of his ability derived from the profits of stock in trade or any other property, for or toward the relief of the poor." Thus it is that the English local taxation has managed to keep clear from the bog of assessing personal property, and the annual value of immovable property, such as lands and houses, within the parish has come to be selected as the simplest and most practicable basis for assessments. The history is of high importance, because the basis of the poor rate was adopted as the basis for all other rates levied in local taxation. Whatever confusion has been introduced has arisen from other causes, such as the constituting poor-law unions containing more than one parish, the levying of county rates, a county having a boundary other than a parish or a union, and the assessing for rates by parish officers who acted independently of each other. Many efforts have been made to introduce a uniform system of assessment, but without success. One of the clearest thinkers on this subject was Sir George Cornewall Lewis. In appearing before a committee on taxation, in 1850, he said: "We have never recognized the principle of having one valuation for all the different rates. If that principle were once admitted, the inducement to have an accurate and complete valuation would be at its maximum, because then you would know that whatever charge might be imposed it would be imposed upon that valuation, whereas if there is one assessment for one rate and another assessment for another rate, and an amended assessment for a third rate, no one cares much about making any assessment perfect. This is one defect of the present system of valuation."

The defect has persisted and become more aggravated each year. In 1870 a special commission came to the resolution that "the great variety of rates levied by different authorities, even in the same area, on different assessments, with different deductions and by different collectors, has produced great confusion and expense; and that in any change of the law as regards local taxation, uniformity and simplicity of assessment and collection, as well as of economy of management, ought to be secured as far as possible." When it is considered that for the five independent valuations for raising rates on property there are in England and Wales more than one thousand valuation authorities, the hopelessness of obtaining uniformity is apparent. With such a multiplicity of agents it is useless to look for good results. There is no fixed or necessary time for making the valuation lists; no uniform system of or scale for making deductions for arriving at the ratable values of certain classes of property; exemptions and allowances are said to be given unduly, through undue pressure on the assessing authorities; and the assessment committees have no statutory power to ascertain from owners or occupiers the rentals and other particulars needed to determine values. The reforms needed are a geographical redistribution of taxing limits and uniform rules of assessments.

If so great confusion can occur where the property to be valued for taxation is visible and tangible property, and where the principles underlying the assessment are few and comparatively simple, what is to be expected when the attempt to reach invisible and intangible property is added?

Constitutional provisions have not secured equality of valuation, and the statute laws are powerless to make effective the sounding phrases of the Constitutions. "Property shall be assessed for taxes," says the Constitution of New Jersey, "under general laws and by uniform rules, according to true value." The Assembly sought to embody this principle or rule in the laws of the State. "All real and personal estate within this State, whether owned by individuals or corporations, shall be liable to taxation at the full and actual value thereof, on the day in each year when by law the assessment is to commence." * Such assertions of the basis of taxation need no further explanation, for the intention of the framers of constitution and law is unmistakable—equal and uniform taxation, a common burden involving a common obligation to discharge it. The practice at once creates the necessity for recognizing the inaptitude of the instruments called upon to carry the law into execution. More than four hundred separate assessors and boards of assessors determine the taxable values upon no uniform system and in defiance of law and Constitution. "In practice they value real estate all the way from twenty-five to seventy-five per cent of its true value, depending on its location, income, etc., and their personal or political prejudices, and value different contiguous areas at different valuations, though of equal values really; and as to personal property, I regret to say, they appear to make no earnest or honest effort to reach it anywhere, except in the agricultural districts, and even there very imperfectly." †

Enough has been said in these articles to show that this defect of method is not peculiar to one State, but is to be found in all. The remedies proposed or adopted have proved ineffectual to produce a better result. It is asserted that the more careful selection of the assessors, a higher salary for service, and a more strict accountability for their acts would introduce a reform; but this could, even under the most favorable of conditions, be only a partial reform. A State assessor with power to remove the assessors has been recommended, but this officer could not become so conversant with conditions throughout the State as to be able to decide on the many questions of assessments coming before him. Certain descriptions of property could be dealt with by such an officer and

* General Statutes of New Jersey, p. 3929, section 62.

† James F. Rusling, in the New Jersey report of 1897.

with an approach to fair and equal treatment. The valuation of the "main stem" of the New Jersey roads was made by civil engineers, and it is believed to have met the constitutional provision as to "true value." In the valuation of a vast quantity of other property no such expert knowledge could be applied, and especially is this true as to "personal property." Real estate might be approximately valued and a *cadastre* or record prepared, but after twelve months the most carefully compiled valuation would be out of date. Before personal property the assessor would still stand powerless. No multiplication of officers or no system of control over the many local assessors can solve this question in a manner satisfactory to justice to both State and taxpayer.

It would seem, then, as if an abandonment of what has been regarded as almost essential features of the State tax systems alone offers relief. No such abandonment can be effected unless an adequate revenue from other sources be provided. The "general property tax," with its futile and laughable incompetency to reach the most profitable sources of revenue, should be modified, and even eliminated as far as is possible. The general principle underlying it, of taxing every form of property, was suited only to a time when the bulk of a man's estate consisted in visible and tangible objects—lands, houses, live stock, and furniture. With every creation of a credit instrument, with the immense development of corporations, the principle has become weaker, until it now stands confessedly inapplicable to at least four fifths of the personal property in existence, and this proportion grows larger each year.

PHASES OF PRACTICAL PHILANTHROPY.

By HARRIET A. TOWNSEND.

THE annual reports of the "Conference of Charities and Corrections" indicate a growing interest in the study of scientific philanthropy. That there has been marvelous progress in methods of charitable work during the past decade no one will deny, but, gratifying as this is (or appears to be on the surface), we find a somewhat discouraging feature in the tendency of the present to multiply institutions, to inaugurate new and extravagant enterprises where theories may be proved, and which threaten to become burdensome to a generous public and to absorb energy in the financial struggle to maintain them which is sorely needed for the more vital issues of the work. The purpose of this article is to give information about simple and practical efforts which have met the test of usefulness and are worthy of imitation. They are being used in four different lines—namely, protection, education, domestic training, and employment.

Protection.—The first protective agency was organized in New York city in 1864; it is truly an American idea, and before that date no organization of its kind had been known in England or on the European continent.

As a result of the civil war many women were thrown upon their own resources, with children to support, and much suffering was endured in the effort to obtain adequate compensation for labor performed. The objects of the parent protective association—" to secure justice for women and children, to give legal advice free of charge, and to extend moral support to the wronged and helpless "—appealed forcibly to practical philanthropists, and there now exist similar agencies in many other large cities in America, such as Boston, Philadelphia, Chicago, Buffalo, and San Francisco. The women's educational and industrial unions, which work " to increase fellowship among women in order to promote the best practical methods for securing their educational, industrial, and social advancement," have all adopted the protective work as an important branch of their endeavor. To give detailed statistics of all that has been accomplished in this line since 1864 would be impossible; indeed, so much of the work is of a private nature which can never be revealed that one must " read between the lines " of the annual reports; suffice it to say that by the protective department of one women's union during a period of fourteen years more than twelve thousand dollars unjustly withheld from working women (mostly in small sums) has been collected, police matrons appointed in three local stations, women given places on public boards, a law passed compelling the appointment of women physicians in all the State insane hospitals, and a law making the guardianship of the mother equal to that of the father (passed by the State Legislature without a single negative vote). All this has been done with little expenditure of money, but through the wise effort of courageous men and women whose service has been rendered not for charity alone, but in the cause of justice, " that each should have what he has justly earned is the first necessity of social life."

One province of the protective work is to endeavor to make more clear the obligation of the employer and employee, and especially in the domain of household service to place the relation on a commercial basis. The problem of unskilled labor in the home is the principal difficulty in the way of such reform, and until the household economic and kindred associations shall bear more fruit it may prove an insurmountable barrier to complete success. During the last ten years the attention of the humanitarian has been frequently called to the injustice of our laws regulating the "age of consent." In some States the age has been raised to sixteen or eighteen years and penalties increased, but through widespread ignorance of the law it is often a dead letter in both small towns and large cities. A law so constantly broken and with impunity provides little protection for the young of both sexes, in whose interest it is framed, and it is a *dead* letter because of the indifference of the public. To spread abroad a knowledge of and help to enforce these laws, which so intimately affect the purity of the home, is worthy the consecrated effort of the noblest and most cultivated women in our land. For this and other like ends the number of protective agencies should be largely increased. In every town, or at least in every county, such an association might be formed. There are only required a few women with brave hearts and clear heads, willing to give one afternoon or evening a week, the free services of one or more able lawyers (which will never be found lacking), a small room for a meeting place, and the work can begin. Let notice be given through the press or in the churches that a protective agency is formed and stands ready to offer sympathy and advice to all women in need. Methods of work are very simple: printed blanks are important to properly record the cases, and letterheads which shall give names of committee and those of the attorneys; when a claim for wages is presented, a courteous letter stating the fact that the wage-earner has asked the assistance of the protective agency, and requesting the defendant to answer personally or by letter and to state his side of the case, will generally receive response; great care must be observed to be just to both parties, and not to make hasty nor unwarrantable decisions.

The laws affecting the rights and property of women of New York have been briefly compiled for the use of protective associations, and it is very easy to obtain in any State a copy of the laws regulating domestic service for reference in making decisions. The Legal Status of Women, compiled by Jessie J. Cassidy (a graduate of Cornell), will be found useful. If in the beginning the work of protection should be misunderstood and resented it matters not; in time it will win the respect and co-operation of the best elements in any community. What a moral force would an "endless chain" of such workers prove in the struggle for universal brotherhood! To give courage to the most humble beginning we have the word of our philosopher that "every reform was once a private opinion."

Domestic Training.—Scientific domestic training or household science is becoming a subject of great interest to all who believe that a truer development of home life lies at the foundation of all social and moral progress.

Three large institutions—Pratt, of Brooklyn; Drexel, of Philadelphia; and the College of Teachers, in New York city—present opportunities for the thorough training of teachers in this comparatively new branch of popular education.

Clubs for the study of household economics are multiplying year by year; the Association of Collegiate Alumnæ has given earnest thought to the domestic problem, and as a result, and in spite of much prejudice, courses of cookery have been made a part of the public-school curriculum in a few of our large cities. The Board of Regents of New York State has recently adopted a syllabus for a course in home science to be used in the high schools. While the movement, as yet, may be said to be in the experimental stage, it is safe to assert that sentiment in favor of the new idea is increasing. The difficulties in the way of a rapid growth are formidable and make the outlook somewhat discouraging.

To properly equip a school for scientific domestic training is in the beginning a considerable expense; the number of skilled teachers ready for the field is small, and their services too valuable to be given without adequate compensation. The cooking schools so far established have not proved self-sustaining, and until more sensible ideas as to the dignity of household labor shall prevail, limitations will continue.

In all reforms we must "dig at the roots" if we would insure a steady and healthful growth. The kitchen-garden idea, originated by Miss Emily Huntington in 1887 for "the purpose of giving the little daughters of the poor attractive instruction in housework," has proved one of the best means of practical philanthropy ever discovered. The New York Kitchen-Garden Association was formed in 1880, and from that, as its crowning work, we have the New York Training School for Teachers. The kitchen-garden lessons are very simple; they include how to make beds and take care of sleeping rooms, set and wait on table, wash and iron clothes, care of a baby and the nursery, how to build fires, clean lamps, sweep and dust, instruction in house-cleaning, marketing, and the care of the person—all taught by miniature utensils to the accompaniment of songs and exercises, which give enthusiasm and variety to the work. The training of the kitchen-garden teacher is not difficult, and young women in any community, by a few lessons as to the methods and a study of kitchen-garden literature, may soon become efficient.

Children of the ages of from five to eleven are eligible for the training, and both girls and boys enjoy the classes. After the various lessons have been mastered, the next step for girls is into the cooking class, and if on account of the expense or for any other reason the scientific teacher is *not* available, the courses may be given by housekeepers. Very practical results were thus obtained by one organization of women. A class of fourteen young girls graduated from a kitchen garden were given instruction for twenty weeks on every Saturday morning; the lessons were divided into four short courses; five each were given in the preparation of breakfast, luncheon, dinner, and supper. Every fifth morning was devoted to a practice lesson, when the little cooks prepared and served a meal without assistance.

While the number of kitchen gardens is increasing there are yet many localities where the good seed has not taken root; no better work in village or town could enlist the faithful service of King's Daughters or of societies for Christian Endeavor. An inexpensive outfit of kitchen-garden utensils can easily be procured and the work begun. When a class is ready to graduate from the kitchen garden the voluntary service of half a dozen notable housekeepers, who will give the simple lessons in cooking once a week, will yield a most satisfactory harvest. The unconscious tuition of the cultivated house mother is often of greater value than all else. A little girl of eleven years given such opportunities enthusiastically exclaimed, "I've taught my mother how to make bread!" The mother, a peasant woman from across the sea, had passed her childhood and youth in the fields, and, like many of her class, had received no training for the responsibilities of motherhood. To the large number of foreigners, who are constantly seeking homes in our free land, the privileges of the kitchen garden and the free cooking school would prove an inestimable blessing. When housework shall take its proper place among the professions, the chaos which now abounds in a majority of American homes will be forever banished. In home making, regarded as one of the noblest objects of every woman's life—in fact, *the* object whenever possible—lies the hope of the future. To this end God speed the kitchen garden and the cooking school!

Education.—The public school and kindergarten, free libraries, art galleries and museums, cheap literature, and compulsory education laws would seem, to the casual observer, to leave little need for the philanthropist in the field of education. A philosopher of today looks forward to the time when "the object of all free education shall be the emancipation of the individual," and to the time "when general education shall be supplemented by special schools for the special vocations of life."

The trend of the present system of education may be in that direction and the prospect more or less hopeful, but that the schools and other opportunities mentioned do not now reach all who need instruction is demonstrated by the success of the various clubs, classes, and lectures which form so important a part of the humanitarian associations of to-day. Everywhere are found men and women of middle age who can not read or write, who were denied even a common-school education in youth; to reach such as these and make them not ashamed to accept and make use of the privileges for which they have secretly longed is practical philanthropy. Among the foreign-born population many children are early forced to help earn the necessities of life, and are taken from school as soon as the law will allow.

The college settlements have already accomplished much for this class, but their work has been confined to thickly settled districts in large communities. The story of The Abandoned Farm in New England is familiar, and bears its own pertinent lesson. Because of the opportunities for education, entertainment, and varied employment which the large city offers, the young people desert the farm, home ties are broken, and many lives ruined. Of the low ideals which prevail in many country districts there are striking illustrations.

A bright woman sojourning for a winter in a small town found that there were two hotels or taverns where liquor was sold, two churches where only occasional services were held, a single schoolhouse kept open during the winter months, no hall except the ballrooms of the hotels (used only for dancing), no library, and no entertainments of a literary order. This woman organized a club or debating society, and after a few months of careful guidance she allowed the members to select their own topic for the last meeting of the season; to her great surprise, a debate was announced on the subject, "Whether it is better for a young man upon coming of age to have one thousand dollars or a good education." The majority decided that it would be better to have the money, because he could then speculate and gain a fortune!

What better missionary work could be done in behalf of education than to establish a "thought center" in every farming region or small town? The system of traveling libraries, a recent and encouraging movement, makes it possible (in some States) to place the best books and current literature in the homes of the farmers and of the inhabitants of the smallest towns. The books can be obtained, made use of, and exchanged for others, so that the interest may be perpetuated; the conditions are not difficult, and the fact that a room or rooms must be provided for the safe keeping and the circulation of the library is important. A traveling library once secured, a "thought center" is established. Lectures, clubs, and classes will follow; they are a natural sequence. In addition to literary topics, talks on personal purity, physical culture (respect for the body as the temple of the soul), and on home ideals (plain living and high thinking) may be given. Good men and women, fitted to speak well on these subjects, will be ready to give their services. Where enthusiasm is once aroused, seed can be sown by such nonsectarian gatherings which fails to take root in the churches.

We are taught that the highest authority within man is the conscience. Rosenkranz, in his Philosophy of Education, gives this fine definition of conscience: "Conscience is the criticism which the ideal self makes on the realized self." To discover and quicken the ideal self wherever possible is one of the noblest aims of practical philanthropy.

Employment.—A recent report of the United States Labor Commissioner, Hon. Carroll D. Wright, states that the number of women laborers is increasing, but that women are more generally taking the places of children than of men; that the encroachment of women upon the occupations held by men is so far very slight, and only in conditions where women are better adapted for the particular work in which they are employed.

"Women," he says, "are considered by many employers to be more reliable, more easily controlled, neater, more rapid, industrious, polite and careful, and less liable to strike than men. Wyoming and Utah are cited as the only States which have laws according to men and women equal wages for equal work. There is still much economic injustice as to compensation for women's work, although some progress has been made within the last few years."

The agitation of the question of "equal pay for equal work," if it has not as yet accomplished much for the woman wage-earner, has at least revealed the fact that women as a class are not as well trained for the work they attempt as men. The number of unskilled women in all branches of trade presents a problem which may well engage the attention of the philanthropist. The necessity of earning to "keep the wolf from the door," the pleasure resulting from financial independence, and a desire to add to "pin money" have all tended to increase the number of girls and women who are seeking employment outside the home. The fever has extended to the smaller towns, and even to the farmers' wives and daughters, until the supply greatly exceeds the demand in many localities, and the women really in need are often crowded to the wall in this inadequate race. In the passing of old ideas as to the proper status of woman much good has been evolved; it is no longer considered degrading to earn one's living, and the woman worker in every field is winning her way to the respect and recognition which she deserves.

What can be done to raise the standard of woman's work, to give more thorough training in vocations for which women are best fitted, to dignify important occupations which suffer from the lack of skilled service and which are not overcrowded because of mistaken ideas, and, above all, to make women ashamed to receive compensation which they do not fully earn?

The employment bureaus connected with the various organizations of women are endeavoring to answer these questions. Their object, as outlined, is to advise and adopt such methods as shall best assist women in their chosen vocations; to also provide a bureau of registration where applications can be received and information given.

A committee of practical women supervises the work and endeavors not only to secure temporary positions, but to confer permanent benefits on those who seek their aid. The applicants usually include stenographers, typewriters, copyists, clerks, governesses, matrons, nurses, housekeepers, seamstresses, laundresses, cooks, and housemaids. It is the rule, and not the exception, to find a girl or woman *specially* fitted for the position she seeks. The majority are not fitted even to do *one* thing well, and the ignorance and assumption shown are appalling.

To discover latent ability, to stimulate the desire to excel, to explain the rights of the employer and employee, and the moral obligations of both, is a part of the privilege of the women who give time and thought to the employment problem.

The Boston Women's Educational and Industrial Union has been able to render excellent service by the distribution of circulars cautioning women against advertisements which offer large returns for work done at home. Its list of fraudulent firms, obtained by thorough investigation, has been sent to other associations, and has already proved of inestimable value to many women who would otherwise have been tempted to send money, allured by the attractive advertisements.

The list compiled gives the names of one hundred firms which are a "delusion and a snare," and which, on account of some trifling technicality, the law seems unable to touch.

To exalt the home and raise the standard of domestic service is another important object—perhaps the most important of all. From the ordinary intelligence office to the employment bureau under the guidance of educated women is a long step for progress.

In all humane effort, the more scientific the methods employed the better will be the results. According to Charles Kingsley, "scientific method needs no definition—it is simply the exercise of common sense."

HERBERT SPENCER AT SEVENTY-NINE.

THE portrait of Herbert Spencer, which forms the frontispiece to this number of the Monthly, is from a photograph taken soon after he reached the age of seventy-eight. Though of late years his health has been unusually feeble, this is scarcely reflected in the face, which still retains in a marked degree the expression of intellectual strength that was so characteristic of his prime.

About the time Mr. Spencer completed the Synthetic Philosophy, or, as it is better known, the Philosophy of Evolution, with the publication of the third volume of the Principles of Sociology, we gave an account of The Man and his Work, from the pen of Prof. William H. Hudson, who had for a number of years acted as his secretary, and was so familiar with his thought that he afterward published an Introduction to the Philosophy, which Mr. Spencer himself has cordially commended. It was naturally supposed by his many friends that having practically carried out his original plan as laid down in his prospectus thirty-six years before, Mr. Spencer would throw off the cares and vexations of authorship, to enjoy the rest and relaxation that his arduous and long-continued labors had earned. But this, it seems, he was not inclined to do. Apparently as active intellectually as ever, he has kept at work to the full extent of his physical ability, devoting himself mainly to such additions and modifications of his published writings as new knowledge and the advance of thought have made necessary. This persistent industry, unusual, to say the least, in one so far advanced in life, the presentation of his latest portrait, and the interest which the world takes in the doings of a man who has so profoundly influenced the thought of his time, make this a fitting opportunity to refer to some of the later incidents in his career.

Though never inclined to plume himself on the importance or the grandeur of his great undertaking, wondering now that he ever had the "audacity" to begin it, and regarding its completion as more an "emancipation" than a triumph, Mr. Spencer is nevertheless entitled to the satisfaction which comes from the contemplation in the evening of a long life of the fulfillment of the purpose to which that life has been devoted. Although he speaks of the series of works comprising the Synthetic Philosophy as "complete yet incomplete," because more things might have been put into it, Mr. Spencer has the unquestionable right to look upon his "system" as finished in all the essentials of a symmetrical and self-sustaining structure; and more than this, he finds it generally accepted as a masterpiece, embodying, if not all the truth, yet a fundamental truth manifested in the growth and order of the universe of matter and mind.

When we regard the comprehensiveness of Mr. Spencer's system, embracing everything there is, and the multitude of the details that had to be considered in the course of its preparation, we wonder at the magnitude of the aggregation that may be formed by the repetition of small daily tasks. The portions of time he was able to give to work were at most very brief, and would be regarded by the majority of workers as insufficient for any great accomplishment; and when the frequent and sometimes long interruptions that occurred are considered, seem absolutely insignificant. Yet in these small fragments of two or three hours a day with many lost days in the year, and several lost years, one of the greatest works in the history of the human mind was carried to its end. The old figure of the dropping of the water on the stone and the fable of the tortoise and the hare are newly illustrated.

Outside of his work in the composition of the Philosophy, Mr. Spencer has always taken a vital interest in leading public questions, making them the subjects of frequent communications to the press, and seeking the co-operation of others when opportunity offered either in combating some needless innovation or aiding some important reform. True to the teaching of his philosophy, it will be observed that in any attempts of the kind his reliance has always been on the power of gradual development, rather than abrupt changes by acts of Parliament or otherwise, to bring about desired conditions. Before his visit to the United States, in 1882, he interested himself in forming an Anti-Aggression League, for the purpose of opposing schemes for extending the lines of British dominion in various parts of the world. Among his associates in this effort were Mr. John Morley, Mr. Frederic Harrison, and the Rev. Llewellyn Davis and Canon Fremantle, now Dean of Ripon, liberal-minded clergymen of the Church of England. The movement found little public sympathy, and no adequate support. Mr. Spencer, severely taxing his strength in promoting it, suffered another breakdown (from which he has never fully recovered), in consequence of which the next number of his Philosophy—Part VI of the Principles of Sociology: Ecclesiastical Institutions—did not appear till the close of 1855. It is worthy of remark in connection with this incident that it seems to have been left for non-Christians almost alone in a professedly Christian community to take the advance in inculcating and disseminating one of the central ideas of the Christian religion; as now, in the United States, with the orthodox church people almost unanimous in supporting war and the wildest schemes of aggression, it has been left for a few New England Unitarians first to dare to speak in protest against an iniquitous and perilous crusade for foreign dominion. Mr. Spencer has never neglected an opportunity to express in unmistakable terms his aversion to militancy, and has been at great pains to demonstrate, as in his Sociology, that the true road to all higher development of society is through encouraging the growth of its industrial factors.

A disposition manifested among English legislators to favor the passage of acts embodying some of the ideas of the socialists led to the publication of a series of magazine articles showing the demoralizing tendencies of measures of paternalism and foreshadowing the disastrous ultimate results that would ensue from the unnecessary interference of the state. These were afterward collected and published under the title of The Man *versus* the State, and are now bound up with the revised Social Statics.

From the spring of 1886 till 1889, when conditions of health compelled entire suspension of the work on the Philosophy, and it was even doubtful whether it could ever be continued, Mr. Spencer dictated the larger part of his autobiography. This has since been completed and put in print, but will not be published during his lifetime. It will comprise two considerable volumes.

Not finding life in a boarding house in all respects suited to his wishes, Mr. Spencer for many years entertained the idea of establishing himself in a home of his own in the suburbs of London, but had been deterred from so doing by the prospective troubles of housekeeping. In the summer of 1889, however, after making such arrangements as promised to relieve him in great measure of these cares, he finally carried out the idea by taking a house in the neighborhood of Regent's Park. But though for some years the bachelor household was a success, we understand it eventually ceased to be so, though it was continued until Mr. Spencer changed his residence to Brighton two years ago. There was wanting in those who had immediate charge of details that feeling of identity of interests and that disposition to co-operate which belong to the ordinary family, and as a consequence differences grew up that could not be permanently composed, and that on the whole did not conduce to domestic tranquillity.

About the time his housekeeping experience was entered upon, Mr. Spencer found himself well enough to go on with the composition of his Philosophy. As he relates in the preface to the Data of Ethics and to Justice, he had already, ten years before, in the imminent doubt of ever being able to complete the work as it had been laid out, determined to devote his attention first to the end and ultimate object of the system—to that part of it to which all the rest was intended to lead up; the purpose, "lying behind all proximate purposes," of finding a scientific basis for the principles of right and wrong in conduct at large. When, now, the question arose again of what work to undertake first, completion of the Principles of Ethics was at once decided upon. As it was still doubtful whether he would be able to accomplish even this, he took up the part which seemed most important—Justice. This was published as Part IV of the Ethics in the summer of 1891. No further serious interruptions occurred in the execution of the work. Parts II and III, completing the first volume of the Ethics, were finished in the spring of 1892; and a year afterward Parts V and VI were added, forming, with Justice, the second volume.

The ethical part of the Philosophy as contemplated by Mr. Spencer having been completed, only two divisions remained to be worked out—Professional Institutions and Industrial Institutions, parts of the Principles of Sociology—to fill out the whole plan. A subsidiary discussion of considerable importance for the integrity of the theory of evolution now intervened to be disposed of before these parts of the work could be proceeded with. Prof. August Weismann had published a book in which he denied the transmission of acquired characters; or, as Mr. Spencer would word it, the transmission of functionally-wrought modifications—a very vital point in all Mr. Spencer's philosophy. Mr. Spencer took the matter up at once, and published several incisive essays refuting Professor Weismann's positions. He opened his argument against the neo-Darwinian position with essays on the Inadequacy of Natural Selection, and on Professor Weismann's Theories, and followed them, at intervals of a few months, with the additional articles, A Rejoinder to Professor Weismann, and Weismannism Once More. Anxious that the question should be brought to the notice of every biologist, Mr. Spencer had reprints of these essays distributed among the teachers of the science all over Europe and America.

The work on the final stage of Mr. Spencer's great undertaking was begun about the middle of 1894. The reading of an editorial in the Popular Science Monthly having suggested to him that it would be desirable to do so, he published the chapters on Professional Institutions—serially in this periodical and in the Contemporary Review. The chapters on Industrial Institutions did not appear till the third volume of the Sociology was issued in November, 1896—the volume which was the culmination of the work so persistently prosecuted in the face of the most formidable and even seemingly hopeless difficulties. In these departments of the system, the argument was pursued, consistent with that which prevails in all the other departments, that in the professions and the industries the principle of evolution operates just as surely and completely as in the derivation of an animal species from its ancestral form.

Appreciation of the value of Mr. Spencer's work had been growing for many years, and its influence was gradually making itself felt in movements of various kinds in the active world. Whatever he wrote or said received attention at once, was discussed, or influenced action. The completion of his Philosophy was deemed worthy of formal notice and a proper subject for felicitation wherever science was known, and in England was regarded as a suitable object for a national memorial. An address of congratulation was prepared for presentation to him, and with it went a request that he would have his portrait painted to be presented to the nation. It has always been his principle to decline offers of testimonials, on the ground that the custom had become an abuse, and persons invited to participate in presentations were often put under a kind of moral obligation to comply, to which he would not be, even incidentally, a party. Consistently with this attitude and not realizing the real nature of the movement in favor of a testimonial and how really spontaneous it was, he wrote to its promoters repeating his objections and asking that it be not pressed. But when the address was presented and he saw the list of illustrious names attached to it, including those of men who had been his antagonists, he yielded to what was evidently a spontaneous feeling of the representative men among his countrymen, and sat for his portrait as soon as circumstances permitted, or about a year afterward, to Mr. Hubert Herkomer. The following is the letter of congratulation and the request for his portrait, with the names of the distinguished signers, and Mr. Spencer's reply:

THE CAMP, SUNNINGDALE, *December 16, 1896.*

DEAR SIR: We, the undersigned, offer you our cordial congratulations upon the completion of your System of Synthetic Philosophy.

Not all of us agreeing in equal measure with its conclusions, we are all at one in our estimate of the great intellectual powers it exhibits and of the immense effect it has produced in the history of thought; nor are we less impressed by the high moral qualities which have enabled you to concentrate those powers for so many years upon a purpose worthy of them, and, in spite of all obstacles, to carry out so vast a design.

To the many who, like us, have learned to honor the man while profiting by his writings, it would be a satisfaction to possess an authentic personal likeness of the author. It has therefore occurred to us that the occasion might be appropriately marked by requesting you to permit us to employ some eminent artist to take your portrait, with a view to its being deposited in one of our national collections for the benefit of ourselves and of those who come after us.

We hope that your health may be benefited by the leisure which you have earned so well, and that you may long continue to enjoy the consciousness of having completed your work.

W. de W. Abney, R. E., C. B., D. C. L., F. R. S., Pres. Physical Society.

Robert Adamson, M. A., LL. D., Prof. of Logic, Glasgow University.

Grant Allen, B. A.

Alexander Bain, M. A., LL. D., Professor of Logic, Aberdeen University.

Sir George S. Baden-Powell, K. C. M. G., M. A., M. P.

Right Hon. Arthur James Balfour, P. C., D. C. L., F. R. S., M. P.

Sir Robert Stawell Ball, LL. D., F. R. S., Lowndean Prof. Ast., Camb.

H. Charlton Bastian, M. A., M. D., F. R. S., Prof. Medicine, Univ. Coll., London.

Frank E. Beddard, M. A., F. R. S., Prosector Zoölogical Society.

John Beddoe, M. D., F. R. S.

Sir Walter Besant, M. A.

E. W. Brabrook, Pres. Anthropological Institute.

Bernard Bosanquet, M. A.

C. V. Boys, F. R. S., Assistant Prof. Physics R. C. S.

T. Lauder Brunton, M. D., D. Sc., F. R. S.

Edward Clodd.

F. Howard Collins.

Sir J. Crichton-Browne, M. D., LL. D., F. R. S.

W. H. Dallinger, LL. D., D. Sc., F. R. S.

Francis Darwin, M. A., M. B., F. R. S.

George H. Darwin, M. A., LL. D., F. R. S., Plumian Prof. Ast. and Exp. Physics, Cambridge.

W. E. Darwin, B. A.

James Donaldson, M. A., LL. D., Principal University St. Andrews.

Right Hon. Sir M. E. Grant-Duff, P. C., G. C. S. I., F. R. S.

Earl of Dysart.

Sir John Evans, K. C. B., D. C. L., LL. D., D. Sc., Treas. R. S.

Sir Joshua Fitch, LL. D.

Michael Foster, M. A., M. D., LL. D., D. C. L., Sec. R. S., Prof. Physio., Cambridge.

Edward Frankland, M. D., D. C. L., LL. D., F. R. S.

Right Hon. Sir Edward Fry, P. C., LL. D., D. C. L., F. R. S.

Sir Douglas Galton, K. C. B., D. C. L., LL. D., F. R. S.

Francis Galton, M. A., D. C. L., D. Sc., F. R. S.

Richard Garnett, LL. D.

Sir George Grove, C. B., D. C. L., LL. D.

Albert C. L. G. Günther, M. A., M. D., F. R. S., Pres. Linnean Society.

Frederic Harrison, M. A.

James Edmund Harting.

Right Hon. Lord Hobhouse, P. C.

Henry Hobhouse, M. A., M. P.

Shadworth Hodgson, late Pres. Aristotelian Society.

Sir Joseph Dalton Hooker, K. C. S. I., C. B., M. D., D. C. L., LL. D., F. R. S.

William Huggins, D. C. L., LL. D., F. R. S.

J. Hughlings Jackson, M. D., LL. D., F. R. S.

William Knight, LL. D., Prof. Moral Philosophy, St. Andrews.

Andrew Lang.

E. Ray Lankester, M. A., LL. D., F. R. S., Linacre Prof. Anatomy, Oxford.

Sir Trevor Lawrence, Pres. Royal Horticultural Society.

W. E. H. Lecky, M. A., LL. D., D. C. L., M. P.

J. Norman Lockyer, C. B., F. R. S., Prof. Astr. Physics, R. C. S.

Right Hon. Sir John Lubbock, P. C., D. C. L., LL. D., F. R. S., M. P.

Vernon Lushington, Q. C.

P. A. MacMahon, R. A., F. R. S., late Pres. Math. Society.

James Martineau, D. D., LL. D., D. C. L.

David Masson, M. A., LL. D., Emeritus Prof. Rhetoric, Edinburgh.

Raphael Meldola, F. R. S., Pres. Entomological Society.

C. Lloyd Morgan, Prin. University Coll., Bristol.

Right Hon. John Morley, P. C., M. A., LL. D., F. R. S., M. P.

C. Hubert H. Parry, Prin. R. Coll. of Music.

General Pitt-Rivers, D. C. L., F. R. S.

Edward B. Poulton, M. A., F. R. S., Prof. Zoöl. Oxford University.

Sir William O. Priestley, M. D., LL. D., M. P.

Lord Reay, G. C. S. I., G. C. I. E.

Lord Rayleigh, M. A., D. C. L., LL. D., F. R. S., Prof. Nat. Philos. Royal Institution.

David G. Ritchie, M. A., Professor of Logic St. Andrews University.

Sir Hfnry E. Roscoe, LL. D., D. C. L., F. R. S.

J. S. Burdon Sanderson, LL. D., D. C. L., F. R. S., Reg. Prof. of Medicine Univ. Oxford.

George H. Savage, M. D., F. R. C. P.

E. A. Schäfer, F. R. S., Prof. Physio. Univ. Coll. London.

D. H. Scott, M. A., Ph. D., F. R. S., Hon. Keeper Jodrell Laboratory, Kew.

Henry Sidgwick, M. A., Litt. D., D. C. L., Prof. Moral Philos. Univ. Camb.

W. R. Sorley, Prof. Moral Philos. Univ. of Aberdeen.

Leslie Stephen, M. A., Litt. D., LL. D.

G. F. Stout.

James Sully, M. A., LL. D.

W. T. Thiselton-Dyer, C. M. G., C. I. E., M. A., F. R. S.

John Venn, Sc. D., F. R. S.

Sydney Howard Vines, M. A., D. Sc., F. R. S., Prof. Botany Univ. Oxford.

Sir Willoughby Wade, M. D., F. R. C. P.

Alfred Russel Wallace, D. C. L., F. R. S.

Beatrice Webb.

Lady Victoria Welby.

Samuel Wilks, M. D., LL. D., F. R. S., Pres. R. College of Physicians.

Hawarden, *November 30, 1896.*

My Dear Sir: It has long been my rule to decline joining in groups of signatures, nor do I think myself entitled to bear a prominent part in the present case. But I beg that you will, if you think proper, set me down as an approver of the request to Mr. Spencer, whose signal abilities and, rarer still, whose manful and self-denying character, are so justly objects of admiration. I remain your very faithful,

W. E. Gladstone.

F. Howard Collins, Esq.

2, Lewes-crescent, Brighton, *December 19, 1896.*

My Dear Hooker: If, as may fitly be said, the value of congratulations increases in a geometrical progression with the eminence of those offering them, I may, indeed, be extremely gratified by the accumulation coming from men standing so high in various spheres. And an accompanying pleasure necessarily results from the good wishes expressed for my health and happiness during my remaining days.

The further honor offered has caused in me some mental conflict. Eight years ago, to the inquiry whether I would sit for a subscription portrait to be painted by Millais, I replied negatively, assigning the reasons that the raising of funds to pay the costs of conferring marks of approbation had grown into an abuse; that the moral coercion under which contributions were in many cases obtained was repugnant to me; and that I objected to have my known and unknown friends asked to tax themselves to the required extent. These reasons survived, and, swayed by them, I recently sent a copy of the letter in which they had been stated to the gentleman with whom the proposal now made originated, thinking thereby to prevent further trouble. I was unaware to how large an extent the proposal had been adopted and how distinguished were the numerous gentlemen who had given it their support. I now find myself obliged either inconsistently to waive my objection or else rudely to slight the cordially-expressed feelings and wishes of so many whose positions and achievements command my great respect. Between the alternatives there seems to be practically no choice. I am compelled to yield to the request made in so sympathetic a manner by signatories so eminent, and at the same time must express to them through you my full sense of the honor done me.

I am, my dear Hooker, sincerely yours,

Herbert Spencer.

Marks of honor offered to Mr. Spencer from time to time since 1871 have included doctor's degrees from the Universities of St. Andrews, Bologna, Cambridge, Edinburgh, and Buda-Pesth; and elections as foreign member or correspondent of the Academies of Rome, Turin, Naples, Paris, Philadelphia, Copenhagen, Brussels, Vienna, Milan, and the Prussian order "*Pour le Mérite.*" Mr. Spencer has been prompted year after year to decline these various honors by the conviction that instead of being, as commonly supposed, encouragements to literature and science, they are discouraging. He contends that they constitute a system of inverse handicapping. In physical competitions it is usual to give the younger a certain artificial advantage when they are set against the elder; but in these mental competitions between the rising men and the men who have risen the reverse practice is followed—the men who have risen have an artificial advantage, and the younger men, who of necessity have much to struggle against, have their difficulties artificially increased by the absence of titles which their competitors possess. Mr. Spencer is quite aware that the course he has persistently followed has cost him much, since a list of honors on the title-pages of his books would have greatly increased the attention paid to them by critics and others. Nevertheless, he has continued to make this practical protest.

Since completing his Philosophy, Mr. Spencer has occupied his working hours with the revision of the Principles of Biology, making the modifications and incorporating the new facts which the progress of the science demands. He recognizes that the advance has been more rapid in this branch than in any other; and that while it might be almost hopeless for him at his time of life to bring a work on biology at large up to date, the case is different in an exposition of the Principles of Biology. The additions to the work include a chapter on Metabolism supplementing the discussion of vital changes of matter; a chapter on the Dynamic Element in Life, to render less inadequate the conception of life previously expressed; some pages on Structure; an account, under the head of Cell Life and Cell Multiplication, of the astonishing actions in cell nuclei which the microscope has revealed; a further chapter on Genesis, Heredity, and Variation, in which certain views enunciated in the first edition of the book are qualified and developed; a review of various modern ideas under the title of Recent Criticisms and Hypotheses; a re-writing of most of the chapter on The Argument from Embryology; and a number of changes incorporated as sections in pre-existing chapters. The articles on Weissmannism are incorporated in an appendix. In performing this work assistance was needed, and the author sought and received criticism and help from different persons, each taking a division falling within the range of his special studies: Prof. W. H. Perkin in organic chemistry and its derived subjects; Prof. A. G. Tansley in plant morphology and physiology; Prof. E. W. MacBride and Mr. J. T. Cunningham in animal morphology; and Mr. W. B. Hardy in animal physiology. The first volume of this work, recently published, has been received with favor by persons of all shades of opinion respecting the questions it touches. The London Times, in not the friendliest of criticisms, says that even persons who do not accept the author's Philosophy will rejoice that he has been able to complete it, and adds that as it stands it "is a marvel of erudition: every page exhibits the wealth and variety of illustration for which Mr. Spencer is justly famous." The latest notice of it that we have observed, a French one in the *Revue Scientifique,* says that in consulting it biologists "will not lose their time, and many will find valuable ideas in it, suggestions by which their experimental work can not fail to be greatly benefited. And, like us, they will be filled with admiration for a work so condensed, and at the same time so admirably co-ordinated, so replete with facts and ideas, of the philosopher who has exercised so great an influence on the science of his times, and who is one of the finest intellectual glories of his country and of the present epoch." Perhaps one of the most significant of recent testimonials of appreciation of the Synthetic Philosophy is the announcement of the publication of a complete translation of First Principles into Japanese by Mr. Fujii, who has devoted several years to the work. "Mr. Spencer's works," it is added, "have long had a great attraction for Japanese translators." Mr. Spencer is now engaged upon the second volume of the Biology.

It was formerly Mr. Spencer's custom to spend about nine months of the year in London and the three summer months in the country, but for several years past he has found the fogs and other gloomy winter conditions of the metropolis too trying. The confinement enforced upon him by increasing feebleness has, moreover, precluded his enjoyment of the social privileges, particularly of the Athenæum Club, which were one of the attractions that made a town residence tolerable. He therefore, at the beginning of 1898, took up his residence in Brighton, where he has a house looking upon the sea, and giving him the benefit of the flood of light which that place enjoys.

At present Mr. Spencer is able to give very little time to work, and being confined to the house most of the time, the routine of his daily life admits of little variety. His first business in the day is to hear the morning paper read; then he attends to his correspondence, and if well enough does a little work. If any matter is going through the press he will generally be seen with a proof close by. His afternoon is spent in such relaxation as is afforded by scanning the illustrated papers and magazines, listening to music, which must always be classical, or, if sufficiently well, a drive; and he retires at ten o'clock.

It is often asked, Miss Mary H. Kingsley says in her West African Studies, whether Christianity or Mohammedanism is to possess Africa—"as if the choice of Fate lay between these two religions alone. I do not think it is so, or at least it is not wise for a mere student to ignore the other thing in the affair, fetich, which is, as it were, a sea wherein all things suffer a sea change. For, remember, it is not Christianity alone that becomes tinged with fetich, or gets ingulfed and dominated by it. Islam, when it strikes the true heart of Africa, the great forest belt region, fares but little better, though it is more recent than Christianity, and though it is preached by men who know the make of the African mind."

President Charles W. Dabny, Jr., of the University of Tennessee, once said in an address that when in school, where the work was all done "at the point of the hickory, so to speak," the best teacher he had "was the kindly old neighborhood loafer," who roamed the woods with him, told him of the times of the wild flowers and the habits of the birds, and taught him to shoot the long rifle. He followed the "natural method, and showed a pupil how to do a thing by doing it."

Editor's Table.

SCIENCE AND THE STATE.

IT is probably not too much to say that the true measure of the intelligence and efficiency of a government is the extent to which, in the various spheres of activity which it controls, it recognizes the authority and adopts the methods of science. There is one department of Government—the remark might be applied to nearly all civilized governments, and very pointedly to our own—in which science receives a large and serious recognition, and that is the Navy Department. We have lately had a striking exhibition, which the world at large has watched with great interest, of the high state of efficiency to which a navy can be brought in a comparatively short space of time. If the question is asked how it was done, there is but one answer: it was done by recognizing science and working on scientific lines. To work on scientific lines is simply to study carefully, in the light of the best available knowledge, the means for accomplishing a desired end, and having found the best means, to adopt them in practice. Our naval administration has fortunately been able to repel if not wholly, at least to a remarkable extent, the intrusion of "political" influence, and has consequently been able to apply itself without serious distraction to the accomplishment of its own special tasks. It has called science to its aid not only as regards purely physical questions, but as regards questions of organization; and the result is that it has succeeded in giving the nation not only ships and guns, but the men who are fitted by knowledge, by training, and by discipline to make the best possible use of the ships and guns.

Next to the navy in the recognition accorded to science, but yet a long way off, comes the army. We are speaking now, of course, of our own army; and what the "long way off" meant in waste of money and of human life, in the suffering and misery of brave men, is a too familiar tale. Had science governed the operations of the land forces and presided over their whole organization to the same extent that it did over the operations and organization of the navy, a certain recent page of history would have borne a very different record, and would not have been so burdened as it is with shame and heartache to patriotic citizens.

Killing and being killed are serious matters, and everybody understands that the business can not safely be trifled with. That is why science is allowed to have its own way almost entirely in the navy, and to exercise a large measure of control in the army, with the effect of rendering the first a nearly perfect machine, and giving to the latter a high degree of efficiency for its own purposes. But have we not here object lessons which ought to be applied to other departments of the Government? Is it only in the matter of killing that the aid of science is required? Can the public at large not rise to the conception that, if science can make splendid killing machines, it might also, if allowed fair play, make excellent administrative machines for peaceful purposes? We have departments which deal with such important matters as currency and finance, agriculture and statistics, the administration of justice, the control of railway traffic, the erection of public buildings and the improvement of waterways, the carrying out of geodetic and geological surveys, the representation of the country abroad, the protection of the public health, and, finally, the great question of public education. It must be obvious to every thoughtful person that, if science could have its say and its way in relation to these matters, it would put them all on the best footing which the existing condition of knowledge permits. It would ask, "What are the objects to be accomplished?" and would proceed to select the persons and adopt the means best fitted to realize those objects. The country would then have a civil service in which economy and efficiency would be equally conspicuous, and which would furnish examples for imitation in private enterprise of the best ways of doing things.

It is needless to say how far removed the present condition of government business is from anything like scientific organization. If killing must be done scientifically, the injured feelings of the politician find relief in insisting that nearly everything else within the sphere of government action shall be done most unscientifically. In the filling of important positions the first thing considered is not the question of fitness for the work to be done, but the question of party advantage. It is not too much to say that a prejudice frequently exists against a man conspicuously qualified by knowledge, experience, and character for a given post. There is an uncomfortable feeling that such a man might not be sufficiently pliable afterward in the hands of those who had appointed him—that the preposterous idea might get into his head that, having obtained the office on his merits, he was at liberty, in the execution of his duties, to think only of the public interest. The preference of the politician, therefore, for "the boys" is easily understood; but "the boys" and science do not work hand in hand.

Our universities are turning out year by year men possessing the highest scientific qualifications, men who have studied both in this country and in Europe, and who are prepared to take any positions in which scientific work is required. Some of these are absorbed by the teaching profession, but the great majority find employment in the various industries of the country. Unfortunately, the attainments of such men give them no special advantage as regards employment in the public service of the country; to qualify for that they must graduate in another school entirely, and get certificates from a very different class of professors. We are far from holding the opinion that men of high education should dissociate themselves from the political life of the country; but it is unhappily true that the kind of interest which an intelligent man who places the nation above party can take in politics is not likely to recommend him to those who have the dispensing of places. The fact should, however, be emphasized that if science does not receive due recognition in connection with the public services, it is not because of any lack of native-born citizens capable of representing it with credit and even with distinction. In this respect America has placed herself fully abreast with the most advanced nations of the modern world, and the Government has only to say what service it requires in order to have its choice of men possessing every qualification to render that service in the most competent and satisfactory manner.

In the last resort, it must be admitted, the fault rests with the people. It is with reluctance that the average elector acknowledges—if he can be brought to acknowledge at all—that any public office requires special qualifications. Such an idea seems to be at war with true democratic doctrine, and to imply a serious abridgment of the powers of the people's representatives. It is readily conceded that private industries and enterprises of all kinds call for training and experience and special knowledge on the part of those who conduct them; but Government business is supposed to be so simple that a wayfaring man, though a pronounced fool, need not err therein. There is more or less hypocrisy, however, in the pretension. The real underlying thought is that, outside of the two great killing departments, no very serious harm can be done by official incompetence, and that the great thing is to provide for "the boys." No idea could be more false. The evil that can be done by unwise economic measures, for example, is incalculable. The army and navy are brought into action only when the dogs of war have been let loose; but the influence of the civil departments of the Government acts unceasingly, and touches the life of the people at a thousand points.

In the matter of public education science has never had the recognition to which it is entitled; nor will it have until the people as a whole know better what science is—until they cease to think of it as a thing of mysteries and technicalities, and come to understand that it is simply the organization of knowledge and the rendering of it available for guidance in the business of life. Meantime, wherever circumstances are favorable, the education of the young, even of the youngest, should be given as far as possible a scientific character. We are strongly inclined to the opinion that, in a country whose fundamental industry is agriculture, an effort should be made in all schools to impart a few sound elementary ideas as to the principles of agriculture. What better starting point could there be for scientific instruction than the soil out of which we derive, mediately or immediately, all that goes to sustain life? It seems to us that no human being should be permitted to be wholly ignorant of the conditions upon which the successful cultivation of the soil depends, and we are persuaded that the subject might, by proper treatment, be made deeply interesting to the vast majority of school children.

A prominent Englishman, Mr. Boyd-Kinnear, has lately been discussing this matter in a London paper. He points out that a knowledge of the scientific principles of agriculture is of fundamental importance, and that whatever else is taught in the national schools, the sciences on which farming rests—physics, chemistry, mechanics, and the physiology of plants and animals—should hold a principal place. He observes that in order to know agriculture it is necessary to understand, first of all, the elements and the action of the soil and the air. There is urgent need, he contends, for teaching what is known on these subjects and for pursuing research into the much larger field of the unknown. In these remarks we entirely concur, and we believe that it would be a happy thing for this country, and for every country, if education could be so administered that, instead of tending, as it so often does, to separate human beings from the soil, it should tend to establish in their minds a sense of their dependence on it and an intelligent, if possible a loving, interest in the operations by which the living of the world is won and the face of Nature is beautified. Here, as we conceive, is where scientific teaching should begin. Such a system of instruction would do much more than increase the intelligence of the farming community, though that would be a benefit of the first magnitude; it would so transform public opinion in general that the divorce we now see between science and the State would no longer be possible. The whole national life would be placed on a sounder basis; and it would probably be found that the result of doing other things scientifically was to diminish very greatly the importance of the arrangements for scientific killing. A nation governed by science would be a peace-loving and peace-maintaining nation.

AGRICULTURE AND NATIONAL LIFE.

SOME very interesting points of view are presented in an article on the food supply of England which appeared a few months ago in The New Century Review of London. The writer, Mr. Richard Higgs, Jr., is very unwilling to admit the commonly accepted view that Great Britain must be dependent upon other countries for the food her people require. He holds that all that is required to make the production of grain profitable in England is the application of higher intelligence and more businesslike methods to the work of the farm. "Speaking generally," he says, "agriculture has been of late a despised industry; intellectual activity has not been brought to bear on it; the men of force and enterprise have failed to recognize that it offers an absolutely unrivaled sphere for the exercise of personal initiative, skill, and knowledge. . . . Agriculture has not been regarded as a means of assisting human development, but rather as a hindrance to progress. A low type of manhood and a slow, unprogressive condition of life are usually regarded as indispensable to agriculture, and consequently it has been neglected by reformers who desire to further the progress of the race."

The writer proceeds to describe the various ways in which, as he believes, agriculture might be made more profitable, partly through lowering of the cost of production, and partly by improvement of the yield; and, finally, he sets forth the disagreeable and very serious conclusions which flow from the proposition —if it is to be accepted as established —that Great Britain can not feed herself by the remunerative production of wheat in the face of low prices. In the first place, the national policy must be one of "bluff and weakness toward other nations: bluff, because it will not answer our purpose to appear weak; and weakness, because, seeing that possible enemies are our largest feeders, we are not in a condition to deal with other nations on equal terms, but must ever face the galling necessity of being dependent upon the good will of a few powerful nations for our daily bread." A nation so situated must be "in the front rank of the nations which are engaging in the mad scramble after markets"; must give itself over "to all the orthodox requirements of diplomacy by engaging in bullying, cringing, lying, deceit, and massacre, in order to secure an outlet for its manufactured goods." Such a fact further implies "the eternal persistence on the face of the land of those hideous monstrosities — our manufacturing towns; those excrescences which, like the dragon of old, are daily vomiting fire and smoke, and by their foulness are blasting and cursing the lives of the people and causing the physical, mental, and moral deterioration of the race. . . . It banishes the poetry, the music, and the glories of an agricultural life, and condemns untold millions to the artificial and unhealthy moral atmosphere of our towns."

It may be said that all this has not much application to the state of things in these happy United States. It has application to at least this extent, that our towns too are becoming bloated and our country places starved. We are fully at one with the writer in his estimate of the agricultural life, and believe that no greater service could be rendered to any country than to place its agriculture on the moral and intellectual, as well as on the economic, level which it has a just claim to occupy. It is the application of science to agriculture that will bring about this result.

Scientific Literature.

SPECIAL BOOKS.

The Theory of the Leisure Class * of Mr. *Thorstein Veblen* is primarily an inquiry into the place and value of the leisure class as an economic factor in modern life. Hardly less attention, however, is given to the origin and line of derivation of the institution, and to features of social life not commonly classed as economic, into the very heart of some of which the study goes. The institution of the leisure class, which is defined generally as that class whose occupation is not industrial, is found in its best development at the higher stages of the barbarian culture, as in feudal Europe or feudal Japan. Whichever way we go from this point it is modified. Its origin appears at a very early stage in history, and appears in the germ in the savage division of the occupations of men and women. The women carried on the industries, and the men went to the hunt or to war—occupations with which the idea of prowess or exploit was associated, giving the stamp of aristocracy. In the highest development of this distinction, the nonindustrial upper-class occupations may be roughly comprised under the heads of government, warfare, religious observances, and sports. In the sequence of cultural evolution the emergence of a leisure class coincides with the beginning of ownership, ownership of women being one of the most conspicuous forms in earlier times, then ownership of property and its symbols. Among the signs of wealth are conspicuous leisure, which includes social distinction and functions and conspicuous consumption, or the possession of fine things not necessaries, and plenty of them. These lead to the setting up of a pecuniary standard of living and pecuniary canons of taste, and the adoption of dress as an expression of the pecuniary culture. In the chapter on Industrial Exemption and Conservatism we are introduced to the reason of conventionalism and of its power. "The fact that the usages, actions, and views of the well-to-do leisure class acquire the character of a prescriptive canon of conduct for the rest of society gives added weight and reach to the conservative influence of that class. It makes it incumbent upon all respectable people to follow their lead." Hence it exerts a retarding influence on social development, stiffening the resistance of all other classes against innovation. Further, the code of proprieties in vogue at any given time or in any society has the character of an organic whole, and any important infringement upon it is likely to derange it. This conservative quality goes so far as to tend toward spiritual survival and reversion. The idea of prowess survives in our barbaric admiration of military exploits, in the taste for sports, and in the gambling tendency, which is based on belief in luck and is enhanced by the desire to triumph at the expense of another. A connection is traced between the admiration of prowess and the cultivation of the devotional spirit which, joined with the fondness for display, leads all worshipers eventually to elaboration of rituals. A further development, classed as

* The Theory of the Leisure Class. An Economic Study in the Evolution of Institutions. By Thorstein Veblen. New York: The Macmillan Company. Pp. 400. Price, $2.

Survivals of the Non-Invidious Interest, is that of beneficences. The Higher Learning was primarily the exclusive privilege of the leisure class, and has still attached to it a mass of ritual in the shape of paraphernalia, ceremonies, degrees, and privileges which grow more elaborate as the college and the community become richer. Devotion to classical learning, which is practically useless, is a form of "conspicuous leisure" and "conspicuous expenditure," but now encounters a rival in athletics, which is equally useless and conspicuous and more costly.

The American Economic Association, at its meeting in Cleveland, Ohio, in 1897, authorized the appointment of a committee to inquire into the scope and method of the eleventh census, with a view of determining what ought to be attempted in the twelfth. In order to make an adequate review of the eleventh census this committee invited a certain number of critical articles on particular portions of the work; and further, in order to discover what might seem weak points in the work and what inquiries it might seem desirable to elaborate in the twelfth census, addressed a circular letter of questions to all the members of the association. Only about sixty replies were received to the questions, but a generous response was made to the invitations to contribute reviews, the result of which is a series of papers by independent authors upon specific topics which are regarded as constituting a very valuable commentary on the Federal census and on statistical methods in general. These criticisms are now embodied in a book * of more than five hundred pages, containing twenty essays by authors each of whom is specially interested in the particular topic of which he treats. These articles include a general review of the statistics of population, by Walter F. Wilcox, and special articles on the negro population, by W. Z. Ripley; the North American Indians, by Franz Boas; Age, Sex, Dwellings, and Families, and Urban Population, by George K. Holmes; Illiteracy and Educational Statistics, by Davis R. Dewey; Statistics of Occupation, by Richard Mayo-Smith; Various Aspects of the Vital and Social Statistics, by Cressy L. Wilbur, Irving Fisher, Roland P. Falkner, and Samuel M. Lindsay; of Agriculture and Farms, by N. I. Stone and David Kelley; Transportation, by Emery R. Johnson and Walter E. Weyl; Manufactures, by S. N. D. North, William M. Stewart, Worthington C. Ford, and Charles J. Bullock; Wealth, Debt, and Taxation, by Carl C. Plehn; Municipal Finance, by Henry B. Gardner; and the Scope and Method of the Twelfth Census, by William C. Hunt. A number of general conclusions are pointed out by the committee as deducible from the papers contributed by these writers. The criticism throughout touches not so much the accuracy of the census as the treatment of the data and the lack of continuity from census to census—both defects believed to be largely due to the insufficient time allowed by law for preparing plans and schedules. The work of the census is believed to be seriously impeded by the number and variety of the investigations ordered, in consequence of which fundamental inquiries can not receive attention. A number of subordinate inquiries might advantageously be transferred to established bureaus or departments under whose scope they would properly fall, and some of which already publish annual volumes of kindred statistics. Among classes of defects or weaknesses in method pointed out in the criticisms are a lack of

* The Federal Census. Critical Essays by Members of the American Economic Association, collected and edited by a Special Committee. Published for the American Economic Association by the Macmilian Company, New York. Pp. 516. Price, $1; cloth, $2.50.

comparability in data from census to census, lack of co-ordination, certain specified faults in method, and faults in the textual analysis of the figures. A summary of the answers received to the circular letter of questions is appended, particularly of the answers to the request to suggest what special information might be furnished by the twelfth census which is not in the eleventh. Many of the writers point to the desirability of a permanent census bureau. The committee has a right to congratulate itself, as it does, "upon this noteworthy collection of papers—the result of the scientific zeal and effort of so many men."

GENERAL NOTICES.

The qualification of Mr. *Frederick A. Ober* to write a book about *Puerto Rico and its Resources* * is indicated by the facts that he visited every point of importance on the island in 1880, and revisited it as West Indian Commissioner for the Columbian Exposition. To the fruits of observations made during these two visits he has added information gathered from the books that have been written about Puerto Rico by Spanish and other officers. A plain, concise account of the island is presented, without sensational exaggerations and free from apparent padding. It begins with the consideration and estimation of the commercial and strategic value of the island. Next its coastal features, rivers—of which it seems to have a relatively good supply—and harbors are described. Then the climate, which is "hot and moist, yet in the main less injurious to the health of white people than that of adjacent islands"; seasons, which are not very variable; and hurricanes, which appear to be rather an important feature. As to products, they are of course tropical, and grow, as in Mexico, in three zones of climate and vegetation. Considering these more specially a chapter is given to Sugar, Tobacco, Coffee, and Cacao; another to Fruits, Spices, Cereals, and Food Plants; and a third to Dyes, Drugs, Woods, and Minerals. The chapter on Natural History includes accounts of game and insect pests. The topographic description begins with San Juan, the capital, and takes in the cities and towns of the coast and the inland towns and routes of travel. A few words are devoted to the government as it has been, and the general characteristics of the people are briefly sketched. Accounts of their foods, drinks, diversions, etc., are given, after which the author passes to the Indians of Puerto Rico. Two chapters relate to the general and the recent history of the island respectively. Considerable information of a statistical character is included in an appendix.

* Puerto Rico and its Resources. By Frederick A. Ober. New York: D. Appleton and Company. Pp. 282, with Map.

President *D. S. Jordan's Footnotes to Evolution* * is made up of popular essays or addresses on the general subject of organic evolution which were given originally as oral lectures before University Extension Societies. Three of them have been also published in this Monthly, and as many in another magazine. Besides the author's own twelve essays, he has inserted in this volume three other papers of special importance, setting forth the present state of knowledge concerning the methods of evolution and of heredity. These are on the Factors of Organic Evolution as displayed in the Process of Development, by Prof. E. G. Conklin; the Physical Basis of Heredity, by Prof. F. M. McFarland; on The Testimony from Paleontology, by Prof. J. P. Smith. President Jordan's own essays begin with a discussion of the kinship of life. This is followed by three articles on evolution, relating to its nature, elements, and factors from the point of view of embryology, and an application of the subject in the paper on The Heredity of Richard Roe, in which the rise of race types from the survival of the existing race with its best results modified and preserved by the

* Footnotes to Evolution. By David Starr Jordan. With Supplementary Essays by Edwin Grant Conklin, Frank Mace McFarland, and James Perrin Smith. New York: D. Appleton and Company. Pp. 392. Price, $1.

survival of the fittest is illustrated. In the seventh essay certain facts of animal distribution as related to the origin of species are considered; in the eighth (Latitude and Vertebrata) the curious biological problem of the possession of more numerous vertebræ by northern than by tropical fishes is considered—a problem the solution of which on any other hypothesis than that of the derivation of species would be impossible. The evolution of mind is then taken up as the sum total of all psychic changes, actions, and reactions, and this development is extended to nations the laws of whose greatness "expand themselves from the laws which govern the growth of the single cell." In the essay on Degeneration a lesson is drawn in favor of individual initiative. Hereditary Inefficiency is discussed in view of the danger from pauperism. Some of the aspects of the woman question are considered in another of the essays. In the paper on The Stability of Truth some recent enunciations of Lord Salisbury, Mr. Balfour, and Haeckel respecting science are criticised. The last essay is on The Struggle for Realities, and concerns the relations of science and conservatism, the Church, etc.

Mr. *Robert P. Porter's* volume on *Industrial Cuba* * deals with living questions of the island. It aims to give a description of Cuba as it appeared to the author when he visited it in the fall of 1898 as special commissioner of the United States to report on its industrial, commercial, and financial condition. It is the result of nearly seven months' inquiry and hard work, in which the island was visited three times, more than five hundred witnesses were examined, and "numerous statements" were studied and analyzed. Among the special subjects treated of are the political and economical condition of Cuba, the outlook for labor, the population, sanitary work, Colonel Waring's report, municipal problems in Havana, banks and currency, the revenue and tariffs, commerce, sugar, tobacco, mines and mining, agriculture and stock, timber and fruit, transportation, navigation, education and religion, and the outlook for the future.

* Industrial Cuba. Being a Study of Present Commercial and Industrial Conditions, with Suggestions as to the Opportunities presented in the Island for American Capital, Enterprise, and Labor. New York: G. P. Putnam's Sons. Pp. 428. Price, $3.50.

Naturalists and bibliophiles have reason to be grateful to Mr. *Call* for his verbatim reproduction of Rafinesque's *Ichthyologia Ohioensis.** The book is of importance as constituting, in the language of the editor, the foundation of fresh-water ichthyology in America. No book dealing specifically with the Ohio Valley area as a region has since been published. The original description of many fish forms which are now recognized by ichthyologists as good species were first given in this book, and many have not since been reprinted. Further, the book contains the first and most complete description, to date, of the Ohio River from Pittsburg down, with notices of all its tributaries. Its value as a book about fishes is not limited to the Ohio River, for the species of that stream are found, to a greater or less extent, throughout the Mississippi Valley, so that it is in effect a necessity to all students of the fresh-water fishes of that territory. The editor regrets that Rafinesque did not preserve in some manner the types of his genera, instead of which, when the technical description was completed and some common form, if one was known, was referred to, the specimen was discarded or rejected. Hence his descriptions can not be compared conveniently with prepared specimens in cabinets or with descriptions made from them, but the student must go to the river and look up the living fish. The original papers of Rafinesque on fishes were published in The Western Review and Miscellaneous Magazine, Lexington, Ky., in 1819, 1820, and 1821. The matter was then arranged in book form from the same type. Two different systems of pagination resulted. These have both been indicated in the present edition by the insertion of the numbers at their proper places. The reprint is an exact copy of the

* Ichthyologia Ohioensis: or Natural History of the Fishes inhabiting the River Ohio and its Tributary Streams. By C. S. Rafinesque. A Verbatim and Literatim Reprint of the Original, with a Sketch of the Life, the Ichthyologic Work, and the Ichthyologic Bibliography of Rafinesque. By Richard Ellsworth Call. Cleveland: The Burrows Brothers Company. Pp. 175. Price, $4.

original, including even typographical errors, excepting only the style of type. Of the original edition only eight copies are known to exist, so that the republication was desirable to preserve the book, as well as for the facilitation of reference, and of this only two hundred and fifty numbered copies are printed for the market.

Mr. *Douglas Houghton Campbell* has endeavored, in his *Lectures on the Evolution of Plants,** to present in as untechnical a manner as seemed feasible the more striking facts bearing upon the evolution of plant forms, believing that it will fill an existing want among English text-books. The substance of the work was given originally in the form of lectures to classes in Leland Stanford Junior University. After an introduction, in which a few fundamental principles are presented, elementary structures are defined, and accepted classification is mentioned, the conditions of plant life are treated of as relating to food substances, water, life, division of labor, and movements, of which all plants exhibit more or less marked ones, that may be spontaneous. While in the simple unicellular plants all the functions are performed by a single cell, a gradual division of labor takes place as we go up, first in a separation of the vegetative and reproductive cells, and later a further specialization of both vegetative and reproductive functions, culminating in the seed plant. This course is described as exemplified in the simplest forms of life, algæ, fungi, mosses and liverworts, ferns, and seed plants of the different classes. The study of the geological relations, fragmentary as their teachings are, has yielded most important evidence for tracing the succession of plant forms. Observation of geographical distribution casts much light on the subject. The relations of animals and plants have an important bearing. The influence of the environment embraces many factors, and is often shown in conspicuous features of form and structure adapting plants to certain sorts of conditions and enabling them to resist others. Plants have thus succeeded in adapting themselves to almost every environment.

* Lectures on the Evolution of Plants. By Douglas Houghton Campbell. New York: The Macmillan Company. Pp. 319. Price, $1.25.

Prof. *Augustus de Morgan's* book *On the Study and Difficulties of Mathematics,** though originally published more than sixty years ago, is still fresh and suggestive and full of matter valuable alike to students and teachers, and possesses qualities of clearness of reasoning and intelligibility from which many mathematical treatises are unfortunately free. Its purpose is to notice particularly several important points in the principles of algebra and geometry which have not obtained their due importance in elementary works in those sciences. Metaphysical points are avoided, and the method of explaining by reference to some particular problem, with hints as to more general adaptation, is adopted. Among the points taken up and classified are the nature and objects of mathematics, arithmetical and algebraic notation, rules and principles, equations, the negative sign, roots and logarithms, geometrical subjects, and application of algebra to measurements. The editor of the present edition, Mr. Thomas J. McCormack, has corrected the errata of the old edition and incorporated such changes as the progress of time and mathematical literature have made seem proper. An excellent portrait of De Morgan is given.

The purpose of *Carpenter's Geographical Reader, North America* (American Book Company), is to give its readers a living knowledge of some of the wonders of the country and continent in which they live. They are taken by the author, Mr. *Frank G. Carpenter*, on a personally conducted tour through the most characteristic parts of the American continent, studying the most interesting features of life and work among the people, learning how they are governed, and how they make their living. Much information is also given concerning the natural resources and the physical features of the countries visited.

The *Japan-American Commercial Journal* is a monthly periodical started with the beginning of the year, with

* On the Study and Difficulties of Mathematics. By Augustus De Morgan New edition. Chicago: The Open Court Publishing Company. Pp. 288.

an especial view to the opening of the empire of Japan to unrestricted foreign trade and residence, for the advancement of the reciprocal interests of Japan and the United States. It is printed in English and Japanese, and is published at Tokio by the Japan-American Commercial and Industrial Association, for $2.50 a year.

The Anglo-Saxon is a monthly magazine, the first number of which is dated November, 1898, "devoted to the identity of the Anglo-Saxon race with the house of Israel." It is edited by *George E. Inglis*, and published by the Anglo-Saxon Publishing Company, Chicago. The title of the first paragraph—"Cui bono"—seems to us to suggest a very appropriate question. The argument seems to be that the house of Israel was appointed to universal dominion, and the Anglo-Saxon race, between England and the United States, with its late war "as nearly a Christian war as any war might be," is getting it.

Among the general papers in the second volume, containing Parts II and III, of the *Report of the Commissioner of Education* for 1896–'97 are those on Federal and State Aid to Higher Education, the First Common Schools of New England, the Learned Professions and Social Control, and the Beginnings of the Common-School System in the South. Statistics of foreign universities are given, with a paper on the Teaching of Geography in certain foreign countries, and consular reports on educational topics. Professor Boas's paper on the Growth of Toronto Children is included. Educational matters of interest in various States are reported upon. An Eskimo vocabulary is introduced. A special report on education in Alaska appears. Part III is devoted to statistical matter.

The *Occult Science Library* is a course of seven essays on the subject of practical occultism by *Ernest Loomis*. The author assumes that the rules based on the occult principles of Nature would, if fully applied, enable any person to invoke the assistance of occult forces in every practical rule of life, and that they may with like success be applied in matters of health, the acquisition of knowledge, the formation of plans, and the solution of religious and ethical enigmas. The publishers claim that the maxims of the book have proved their efficiency to the satisfaction of thousands who have read them. (Published by Ernest Loomis & Co., Chicago.)

Mr. *James G. Needham* has furnished, in *Outdoor Studies* (American Book Company), one of the fullest and most systematic guides or "reading books," as he calls this one, for Nature study that we have seen. Recognizing that there is no lack, in numbers, of books offering object lessons, etc., for children of the earlier years intervening between the primary and the high school, he has prepared this book to supply for the later years of that period "a few lessons of greater continuity, calling for more persistence of observation and introducing a few of the simpler of our modern conceptions of Nature at large." The lessons presuppose some years of experience of life and some previous training in observation; they are given simply for the sake of the interest and educative value of the facts and phenomena of Nature which they set forth; and they have been written more for the boys and girls than for the teachers. The things described—birds, insects, plants, etc.—are such as can be seen anywhere. Mr. Needham tells how to study them and learn what they mean.

In *Commissioner Hume, a Story of New York Schools*, a sequel to Roderick Hume, the Story of a New York Teacher, Mr. *C. W. Bardeen* has undertaken to give a picture of rural New York schools, or rather of the administration of school affairs by commissioners as they were in 1875, and he declares it to be accurate. He represents, however, that the general tone of the commissioners has vastly changed in the period that has intervened since then, and the conditions described in the volume no longer prevail. The book is offered, therefore, as a contribution to educational history. (Published by C. W. Bardeen, Syracuse, N. Y.)

The southern half of Missouri and the Black Hills of South Dakota offer exceptionally delightful regions for the study of caves, or speleology, as well as of geology and geography. Each of these regions has its peculiar geological history and its own scenery, and possesses a number of truly wonderful caves. Some of the more important of these caves and the scenery amid which they lie are described by Mrs. *Luella Agnes Owen* in the book *Cave Regions of the Black Hills* (Cincinnati: the Editor Publishing Company), and we have been much interested in reading the accounts. The descriptions are introduced by summaries of the methods of the formation of caves and of the results of the geological and topographical explorations of the regions in which they are situated, as presented in official reports and scientific memoirs. The descriptions are for the most part relations of the author's personal explorations of the caves. The most important of these caves are Marble Cave, "the finest yet explored in Missouri," and Wind Cave, in South Dakota, said to be the largest known after the Mammoth Cave. Others are Fairy, Powell, Stone County, Oregon County Caves and the Grand Gulf in Missouri, and the Onyx and Crystal Caves in South Dakota. Many illustrations are given. The author has fine descriptive powers, but her literary style needs discipline. She is the first American, and the only woman, so far, elected to membership in the Société de Speleologie of Paris.

A valuable paper on *Sympathetic Strikes and Sympathetic Lockouts* is published by Mr. *Fred S. Hall* as the first number of the eleventh volume of the Columbia University Studies in History, Economics, and Public Law. In it, the author having fixed the definition of sympathetic strikes and lockouts as distinguished from those not sympathetic, and having found the difference between a strike and a lockout, discusses the origin and development of the two sympathetic movements, analyzes them, and forecasts the future as it is indicated by the past. Illustrations are freely drawn from the important strikes and lockouts that have occurred in the United States and abroad for a number of years past.

The Year Book of Colorists and Dyers, in the opinion of the author, Mr. *Harwood Huntington,* supplies a want, for, so far as he is aware, there are no other portable works in the English language to which the color-chemist can refer and find the information which he requires the oftenest. The object of the present publication is to meet the demand for a review of the advances made annually in the special field worked in by dyers and colorists—in the bleaching, dyeing, printing, and finishing of textiles—and it endeavors to do this with accuracy and brevity. (Published by the author, New York.)

The first number of *The Socialist Almanac and Treasury of Facts* has been issued in accordance with a decision of the National Convention of the Socialist Labor Party, held in New York in July, 1896. It has been prepared by *Lucien Sanial,* to whom the task was assigned by the National Executive Committee. A large proportion of it is historical, and consists mainly of monographs presenting views of the movements and condition of "militant socialism" in Germany, Austria, Italy, Spain, and Belgium, from its beginning to the present day. Special attention is invited by the author to the monographs on Italy and Spain as tracing the struggle between socialism and anarchism to its beginning. The second part of the book contains statistical matter and comments on economical and social conditions, which, if the argument on "Who owns the Savings?" is a specimen of its quality, must be accepted with many reservations.

Prof. William Wadden Turner, a native of England who came to this country at an early age, became an eminent scholar in Oriental literature, and in 1842 a professor of that subject in Union Theological Seminary. He was called thence to Washington in 1852 to organize the library of the Patent Office, where his work was of great value. Thence he was taken by Professor Baird to catalogue and arrange the library of the Smithsonian Institution. He associated his sister with him in this work and as recorder of scientific collections and exchanges in 1858. She continued there after his death the next year, and served the library faithfully and efficiently, going with it to the Congressional Library when it was removed there, till 1886, when she resigned on account of age. She died in 1896. A *Memorial* of the two and of their elder sister Susan has been prepared by Mrs. *Caroline H. Dall* and has been printed privately.

The author of *What is This?* after a brief discussion of the personality of Jesus and the present degenerate condition of Christianity, goes on to say: "We must have another revelation, therefore. It seems to be a necessity. But what troubles me is this: can it be possible that any part of this revelation can come through one as humble as myself? What have I seen and what have I heard? . . . I have often pondered the great questions of man's origin and future; never until now, never until I heard this voice, have I had any glimmer of a solution of this great puzzle. I know I am nothing, but can not the Supreme Being use a mere nothing to accomplish his purpose?" Notwithstanding the author's avowed unworthiness, he seems to have been selected, and we have from his pen a new and considerably detailed book of genesis.

PUBLICATIONS RECEIVED.

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Agricultural Experiment Stations. Bulletins and Reports. Delaware College: No. 43. Veterinary Studies, Milk Legislation, and Basic Slag as a Fertilizer.—Michigan State Agricultural College. No. 169. Notes from the South Haven Sub-Station. By L. R. Taft and T. T. Lyon. Pp. 108; Nos. 170, 171. Vegetable Tests and Bush Fruits. Pp. 42; Nos. 172, 173. Combating Disease-producing Germs and Killing the Tubercle Bacillus in Milk. Four authors. Pp. 30.—Montana: No. 18. The Alkali Soils of Montana. Preliminary Bulletin. Pp. 30.—United States Department of Agriculture: No. 24. Proceedings of the Convention of Weather-Bureau Officials, held at Omaha, Neb., October 13 and 14, 1898. Pp. 184, with plate.

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Blackman, William F. The Making of Hawaii. A Study in Social Evolution. New York: The Macmillan Company. Pp. 266. $2.

Breese, B. B. On Inhibition. (Monograph Supplement to the Psychological Review.) New York: The Macmillan Company. Pp. 65.

Bulletins, Reports, Transactions, etc. Academy of Natural Sciences of Philadelphia, 1899. Part I. January, February, and March. Pp. 216, with plates.—American Society of Naturalists: Records. Vol. II, Part IV. Providence, R. I. Pp. 36.—New York Academy of Sciences: Annals. Vol. XII, Part I. Pp. 89.—New York State Reformatory, Elmira: Year-Book for 1898. Pp. 126.—Société Royale de Canada: Report of the Geographical Society of Quebec. Pp. 2.—United States Department of Labor: Bulletin No. 22. May, 1899. Pp. 42.—University of Tennessee: Record, Review of 1898. Knoxville, Tenn. Pp. 56.—Wyoming State Medical Society: Transactions. May and June, 1899, E. Stuver, Secretary. Pp. 75.—Zoölogical Society of Philadelphia: Twenty-seventh Annual Report of the Board of Directors. Pp. 25.

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Davis, Lucius D. Ornamental Shrubs for Garden, Lawn, and Park Planting. New York: G. P. Putnam's Sons. Pp. 338. $3.50.

Dexter, E. G. Conduct and the Weather. (Monograph Supplement of the Psychological Review.) New York: The Macmillan Company. Pp. 101. $1.

Erlingsson, Dr. Thorstein. Ruins of the Saga Time. (Travels and Explorations in Iceland.) London: David Nutt. Pp. 112, with map.

Fergusen, James. A New System of Natural Philosophy. Book I. The Physical Universe. Published by the Author at Talmage, Neb. Pp. 240.

Field Columbian Museum, Chicago. Publication No. 30. New Rodents from the Olympic Mountains. By D. G. Elliot. Pp. 4.—No. 31. Cold-Blooded Vertebrates from the Olympic Mountains. By S. E. Meek. Pp. 10.—No. 32. Catalogue of Mammals from the Olympic Mountains, Washington. By D. G. Elliot. Pp. 36, with plates.—No. 33. The Ores of Colombia. By H. W. Nichols. Pp. 56, with maps.—No. 34. The Mylagaulidæ. An Extinct Family of Sciuromorph Rodents. By E. S. Riggs. Pp. 8.—No. 35. A Fossil Egg from South Dakota. By A. C. Farrington. Pp. 8, with plates.—No. 36. Contributions to the Paleontology of the Upper Cretaceous Series. By W. N. Logan. Pp. 16, with plates.—No. 37. Mammals from Oklahoma Territory. By D. G. Elliot. Pp. 4.—No. 38. Mammals from the Indian Territory. By D. G. Elliot. Pp. 8.

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Hrdlicka, Dr. Ales. Anthropological Investigations of Children in the New York Juvenile Asylum. Pp. 86, with plates.

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Fragments of Science.

Climate and Acclimatization.—In view of the rapid growth of West Indian and South American commerce and the considerable emigration to Cuba and neighboring islands, which our present relations with them will probably bring about, the following extracts from an editorial in the London Lancet are of interest: "The American nation has entered upon a new and, in a sense, imperial policy, which may be regarded as forming an epoch in its history. This brings it face to face with the problem of colonization and acclimatization—a problem which we have had to confront long ago and toward the solution of which we have ever since been slowly fighting our way by following on the lines of the best practical measures of hygiene known to us. 'The white man's burden' has proved a tragical one in its drain on the life of the young manhood of this country, notwithstanding the very large measure of success which has attended our sanitary efforts in this direction. The Americans, having taken up their burden, will, no doubt, like the practical people they are, set about their task in a practical way. The four principal factors in the production of climate, according to Buchan, are distance from the equator, height above the sea, distance from the sea, and prevailing winds. The equatorial region has the most equable climate; tropical regions have much greater variations of temperature than those near the equator, and have a hot and cold or dry and rainy season. The isothermal lines of mean temperature do not supply a graduated measure of the effects of temperature on animal life. So far as climate is concerned, no single meteorological influence appears, however, to equal the effect of temperature upon health, and its range is of more importance than its mean. The European under a tropical climate suffers from anæmia, diseases of the digestive system, especially of the liver, from malaria, dysentery, typhoid fever, and yellow fever. It is not at all easy to say, however, how much of the excess of mortality of Europeans in tropical and subtropical countries is simply attributable to climatic heat *per se*, and is consequently inevitable and not the effect of malaria, or how much of it is the direct consequence of habits of life and of the neglect of sanitary laws and of personal hygiene. As Arnould rightly said, the *habitudes alimentaires* of the Anglo-Saxon constitute one of the stumbling-blocks to health, but by far the most important is malaria, compared with which the rest are relatively insignificant. Mr. Chamberlain was right when he said the other day that 'the man who shall successfully grapple with this foe to humanity and shall find a cure for malarial fever and shall make the tropics livable for the white man, will do more for the world and more for the British Empire than the man who adds a new province to the wide dominions of the Queen.'"

"Picture Telegraphy."—The following account of the new so-called picture telegraphy is from the New York Electrical World and Engineer: "The apparatus consists of a receiver and transmitter, similar in appearance and in mechanism. The picture to be transmitted is drawn on a heavy piece of metal foil, the lines of the drawing being made with an insulating ink. The foil is then secured on the circumference of a horizontal cylinder on the transmitter, the cylinder being of about the size of a typewriter rubber roller. There is a similar cylinder on the receiver, on whose surface is clamped the paper upon which the drawing is to be reproduced; over this is superposed carbon paper, which is covered in turn by a sheet of thin paper. A stylus actuated by an electro-magnet is adjusted close to the surface of the latter, and each time a current is passed through the electro-magnet the stylus is forcibly pressed against the moving surface of the cylinder, and a corresponding mark is made on the two sheets in contact with the carbon paper; the outer sheet serves merely to offer a smooth surface to the stylus and to enable the operator to see that the picture is being properly reproduced. The transmitting cylinder passes under a similar stylus, which latter closes the circuit between the receiving and transmitting ends when it rests upon the foil, and opens the circuit when it passes over the lines drawn with insulating ink, in the latter case actuating the stylus magnet at the receiving end, which leaves a mark on the paper of the receiving cylinder in the form of a line corresponding to the width of the insulation over which the transmitting stylus is passing. The stylus at each end of the line is simultaneously advanced at the end of each revolution of the cylinders by a screw of small pitch. From the description it will be seen that if the surface of the foil on the transmitting cylinder were entirely insulated the receiving stylus would merely draw a number of parallel lines on the paper corresponding to the turns of the screw, and separated a distance corresponding to the pitch of the screw and the angle through which it is turned at each operation. Four different rates of advance may be given to the stylus, corresponding to as many different angles of advance that may, by appropriate mechanism, be given to the screw. The two cylinders have synchronous motion, so that all the marks or lines on the receiving cylinder correspond to widths of insulating ink traced over on the transmitting cylinder. Synchronism is obtained as follows: Connected with both receiver and transmitter is an electric motor which, at the end of every revolution of the cylinder, raises a weight, which acts on a clock train when falling and thus gives motion to the cylinder. At the end of each revolution of the transmitting cylinder a contact is made which locks for an instant the receiving cylinder when it arrives in a position corresponding to a similar position of the transmitting cylinder. Thus it will be seen that each cylinder begins its revolution from identical positions and at the same instant, and as the clockwork of both receiver and transmitter are duplicates, approximate synchronism is maintained during a revolution. Owing to the use of carbon paper, the lines made by the receiver are of considerable width, with the consequence that the resulting picture does not have the appearance of being made up of parallel lines, as in the case of reproductions by the original Caselli picture telegraph, of which the system described is a modification. The Hummell apparatus appears to be entirely practicable, the simplicity of its synchronizing mechanism giving it a great advantage over former types of Caselli picture telegraphs. The apparatus has been worked duplex with success. In one instance, a few days ago, a picture was sent from New York to St. Louis while one was being received from the same place in New York, the latter picture in addition being received simultaneously at Boston."

The Charges on Country Checks: an Economic Mistake.—An article in the May issue of the Yale Review, discussing the recent adoption by the New York banks of a rule imposing a "collection charge" on all country checks handled, takes the view that the new rule is a mistake. After reviewing the history and present position of the Bank of England; calling attention to the fact that although it is a private enterprise its position is used as a governor, so to speak, of English finance; the similarity to it in position and power for good or evil of the association of banks known as the New York Clearing House is pointed out; the review goes on to say: "In the associated banks of New York, as in the Bank of England, is kept a very large part of the reserve on which the great financial transactions of a whole country are based. The system of 'reserve cities' for holding large deposit accounts of country banks, in which New York is by far the most important center, is but the recognition in the national banking law of this great fact of a central reserve, and the power of utilizing such deposits, indirectly extended by the law which allows and encourages country banks to hold a large part of their legal reserve in the form of deposits in New York, probably constitutes a much more valuable privilege than the rights of note issue enjoyed by the Bank of England. In extraordinary emergencies the parallel is even closer. Just as the Bank of England is encouraged to expect a modification of the restrictions on its right of note issue, as a means of extending its effective currency reserve in times of panic, so the New York banks, by their system of clearing-house loan certificates, are encouraged and expected to evade those provisions of our national banking laws which restrict their power of issuing notes to meet an emergency. . . . The exercise of this function of holding a reserve for clearing the business of the country is attended with some expense, as well as with much profit. One of the most vexatious of these expenses has been the cost of collecting country checks. . . . Under these circumstances they have adopted a rule imposing such charges on country checks as to compel a large part of the remittances to be made in the form of bank drafts on New York city, rather than individual checks on country banks supposed to have accounts with some New York bank. This rule will save the New York banks something like two million dollars annually. It will not prevent any solvent man from making remittances, for if he has a deposit in his local bank and his local bank has a deposit in New York he can buy a draft to send as a remittance, which will pass through the New York Clearing House without question or expense. Yet, in spite of these plausible arguments, we believe the action of the New York banks to be a mistake of very serious magnitude, an inconvenience to the public, a probable loss to deposit banking in the long run, and, worst of all, a serious blow to the cause of sound currency throughout the country. It seems to us, in short, a case where narrower duties and economics have been allowed to crowd broader ones out of sight." The review then goes on to show how great an amount of inconvenience and loss of time in the aggregate the new rule is going to cause, and finally says: "In a popular government the greatest safeguard against soft money—we may fairly say the *only* real safeguard—is to prevent the growth of a demand for soft money. And of all the means of prevention at our command the most effective is the encouragement of the habit of paying by checks. The habit of paying by check is very general in all large business centers, and has been rapidly extending into the smaller centers, and the most serious public danger in the action of the New York banks is that it seems likely to deal a severe blow to such progress."

La Nature's Second Scientific Excursion.—A second scientific excursion to an interesting district of France is planned, by M. Henri de Parville, of *La Nature*, to start from Bayonne August 25th. It will spend about two weeks, following the chain of the Pyrenees from the ocean to the Mediterranean. Among objects of interest enumerated are the scenery at Biarritz, Pau, Cauterets, and Bigorre; fine architecture at Toulouse, Carcassonne, Elne, etc.; glacial phenomena and thermal waters along the whole mountain chain; manufactories, including iron works at Bouchain, woolen mills at Bigorre, cigarette factories at Perpignan, and the Arago Maritime Laboratory and the sanitarium at Banyuls. The excursion will be "personally conducted" by the eminent anthropologist and archæologist, M. E. Cartaillac. The excursion last year, to the Central Plateau and the Tarn, was an eminent success. The programme of the present one seems equally attractive. M. de Parville and his associates deserve great credit for their sagacity and enterprise in inaugurating these excursions, which now promise to become annual. We can conceive nothing more profitable and conducive to real pleasure in a vacation than the tour in the company of men having a common interest in the pursuit of knowledge of Nature and art, through such magnificent regions as that of the Pyrenees or through a country so full of natural wonders and novelties as that of last year's excursion. And it will be an incalculable advantage to be under the guidance of so eminent a student and one so familiar with the remarkable features and the antiquities of southern France as M. Cartaillac.

The American Association Meeting.—The forty-eighth annual meeting of the American Association for the Advancement of Science will be held at Columbus, Ohio, August 19th to 26th. The association headquarters will be in University Hall, of the Ohio State University, and the headquarters of the council will be at the Chittenden Hotel. The president of the meeting will be Prof. Edward Orton, of the Ohio State University. The vice-presidents or chairmen of sections will be: Mathematics and astronomy, Alexander Macfarlane; physics, Elihu Thomson; chemistry, F. P. Venable; mechanics and engineering, Storm Bull; geology and geography, J. F. Whiteaves; zoölogy, S. H. Gage; botany, Charles R. Barnes; anthropology, Thomas Wilson; social and economic science, Marcus Benjamin. The Permanent Secretary is L. O. Howard, Cosmos Club, Washington; General Secretary, Frederick Bedell, Cornell University; Secretary of the Council, Charles Baskerville, Chapel Hill, N. C.; Treasurer, R. S. Woodward, Columbia University, New York. The address of retiring President Putnam will be delivered Monday evening, August 21st. Saturday, August 26th, will be devoted to excursions to Fort Ancient and elsewhere. Receptions and shorter excursions will be provided at hours that will not conflict with the appointments of the association.

The Desire for Notoriety a Cause of Crime.—Under the title *Luccheni Redivivus* the London Lancet gives some interesting psychological data which have been obtained since the imprisonment of Luccheni, the assassin of the Austrian Empress. Twice since his trial and conviction he has attempted suicide. Within the last few days (May 13th) his moral condition has undergone a change confirmatory in a significant degree of the diagnosis which found vanity or megalomania at the root of his crime. The cantonal juge d'instruction in an attempt to ascertain if possible his associates in the crime, visited him in his cell and approached the subject with what seemed to himself due dexterity and caution. At once the previously downcast and abject creature brightened up, his eyes sparkling with gratified self-importance. "*I giornali riparlano di me?*" (So the journals are talking of me again) he exclaimed interrogatively. The judge disclosed the object of his visit. Luccheni thereupon dallied with his interlocutor, smiling at his reminiscences of the crime, assuming airs of reticence, even indulging in self-contradiction to tease if not torment his judicial antagonist. It was learned, however, that in the preliminaries leading up to the assassination he really had accomplices; beyond this nothing new was elicited from him. The point of chief importance, however, to be observed in this account is the large part which vanity and a desire for the widespread public attention which such crimes bring about plays in reconciling the criminal to his fate, and even leading to the commission of the crime in cases where the mental balance is very unstable. Hence this class of criminals should always be tried and punished with as little publicity as possible, not only because this policy deprives the individual of a show, with himself as the center, but also because every such public trial is liable to lead to the commission of similar crimes by other mentally unsound degenerates, who are sure to attend such spectacles whenever it is possible.

Bounties and Free Trade.—Much discussion is going on in England over the question of bounties and the propriety of putting a tariff on those imported articles which, owing to bounties or other form of government aid at their place of manufacture, can be sold "too cheaply." The following paragraphs are taken from an article in the London Spectator: "In our opinion there can be no question between the policy of free and open market and the policy of only allowing goods to be sold here 'at the natural price of the world's market.' We hold that the maintenance of an open and unhindered market is essential to our welfare; . . . that is the real principle involved, and that is the ground on which this question of bounties must be fought out. It is not Cobdenism or free trade that is involved, but that which underlies them both—the great principle of the free and open market. . . . We attach such immense importance to the open market because we believe not only that our internal prosperity is essentially bound up with the right, not merely of consumers, but of producers, to buy as cheaply as they can and where and how they will, but that the empire itself rests upon the preservation of a free and open market. Mr. Morley never spoke a truer word than when he insisted that Cobden and Bright and the old free traders were empire builders. That they were so and that our empire could not possibly have grown up except with the help of free trade and a market always open must be clear to all whose eyes are not blinded by that evil and foolish spirit of commercial jealousy under which a man, in order to injure his neighbor, wounds himself. Free trade made our empire possible and created what the world before had never seen, overwhelming commercial power wielded without jealousy or narrowness and based on wide and liberal ideas. How long would our colonies have tolerated the connection with us had we been forever worrying them with tariffs and excluding this or that product because it was unnaturally cheap? . . . As it is, we bid all men welcome in our markets and none are aggrieved. . . . Foreign powers may hate us for our wealth and prosperity, but not one of them would care to spoil their best market. How would the commerce of France, or Germany, or Russia get on if England were ruined and the English market destroyed? The principle of maintaining a free and open market, coupled with our moral and physical energy, and our liberal aims and aspirations have given us a great and splendid empire. Are we to risk its destruction because the sugar refiners grumble, and because the words of Cobden on another subject may possibly be interpreted to show that he would not, were he alive, have voted against the imposition of countervailing duties?"

Forest and Animal Life of the Catskills.—The interior region of the Catskill Mountains surrounding Kaaterskill Junction is assigned, by Dr. E. A. Means in a paper of the United States National Museum, to the Canadian faunal region, with a slight mixture of the Alleghanian in the farming lands on the banks of Schoharie Creek. A few mammals of the Upper Austral zones, however, such as the New England cottontail, the deer mouse, and the gray fox, appear to have extended their ranges into the locality by following up the clearings. Though the region is now again well wooded, only the barest tags and remnants yet remain of the splendid forests that once covered the area. All is second growth except in the rockiest gulches, whence the lumber can not be extracted, and about the rocky summits of a few mountains of the East Jewett ranges. While the original forests seem to have been of conifers, the woods are now very thoroughly mixed, and the succession of trees according to altitudes, with its strongly marked division lines, is no longer seen. Specimens of fifty-eight species of trees and shrubs have been collected and placed in the National Museum. Only ten species of mollusks, one crustacean (the common crawfish), probably a dozen fishes (the author identifies eight and mentions others), eight batrachians, two snakes, and a turtle have been found. Of mammals, thirty-five species are described as known to occur at the present time, and eight as of doubtful occurrence now.

Geology of Block Island.—In a study of the geology and natural history of Block Island, of which Arthur Hollick gives a summary in the Annals of the New York Academy of Sciences, the most important problem was whether the Amboy clay series was represented in the island. Of fifteen species of fossil leaves and fruit capable of identification, represented by about twenty-five specimens, at least nine were typical of the Amboy flora. Observations on dip and strike of strata tended to emphasize the fact of contortion of glacial action, the dip in all cases being toward the north, indicating that the strata had been pushed southward in a series of overthrust folds by the advancing ice front. The flora may be divided physiographically into that of the hills, the peat bogs and pond holes, the salt marshes, the sand dunes, and the salt water. Trees are rare, and such vegetation as is dependent on forestal conditions is absent. The bulk of the surface is that of a typical morainal region, with rounded hills and corresponding depressions, many of the depressions being occupied by swamps or ponds, often without any visible outlet. Running streams are few and insignificant, and permanent springs occur only in a limited number of localities. The soil is bowlder till and gravel, with sand in the dunes and beaches, and there are no outcrops of rock. The flora is morainal in its general character, except in the peat bogs and on the limited sand dunes and sea-beach areas, and has its nearest analogue in that of Montauk Point. "In fact, if we could imagine Montauk Point to be despoiled of its few remaining trees and converted into an island it would bear a striking resemblance, geologically and botanically, to Block Island." Considering the geological features of Long Island, Block Island, Martha's Vineyard, and Nantucket, and comparing their floras, we find that all except Block Island have some of the plain region remaining with them, on which a characteristic flora finds a home. Block Island has lost all its plain region and accompanying flora, and is now merely an isolated portion of the terminal moraine, with small areas of modern sand beach and dune formations, affording a home only for such species as can exist under such conditions. The island appears to have been extensively wooded before it was settled, and large stumps, together with roots and branches, are found in some of the peat bogs. The scarcity of animal life on the island is sure at once to attract the attention of the observer from the mainland. Tree-living birds are absent, but robins, bank swallows, red-winged blackbirds, and meadow larks occur with some frequency. Among mollusks, the periwinkle of the Old World, an importation or migration, is the most abundant. Frogs and spotted turtles are plentiful, and a few small striped snakes were seen by Mr. Hollick. The archæology of the island is being studied by persons specially interested in the subject.

The Claims of the High School.—In considering the right of the public high school to be a just charge upon the public treasury, Mr. Frank A. Hill, of the Massachusetts State Board of Education, finds that less than one fifth of the school money raised in the State is expended on account of these schools, whereas if the number of pupils in each of the thirteen grades of school was equal and the money was evenly divided, the higher grades would be entitled to four thirteenths, or nearly one third of it. To an objection sometimes raised against the high-school system that the "toiling millions" will have no use for more than the teaching of the elementary grades, Mr. Hill asks, Who has a right to decide whether one child shall have a greater or less amount of instruction than another? "And so freedom of choice, when the question of what one's life work shall be comes up, is a basic thing in government by the people. Upon the wisdom of this choice turns the welfare of each unit in the State, and therefore of the State itself." Hence the State has no right to refuse to one any opportunity of preparing himself to exercise this freedom of choice which it accords to another. There has never been a time since 1647 when the laws of Massachusetts did not require certain towns to maintain grammar schools, of which the high schools are the modern equivalents, at public expense, and when the colony became a State a perpetual obligation was imposed upon the Legislature and magistrates "to cherish the interests of literature and the sciences and all seminaries of them, especially the university at Cambridge, public schools, and grammar schools in the towns."

Degeneration. — Dr. William C. Krauss, in a paper on The Stigmata of Degeneration, describes degeneration as meaning, in pathology, the substitution of a tissue by some other regarded as less highly organized, less complex in structure, of inferior physiological rank, or less suited for the performance of the original function. The same definition may apply equally well, according to Dr. Krauss, in human ontogeny, "where we can regard a normal man as possessing a certain number of units of strength capable of supplying or exerting a certain number of units of work or force, varying of course according to the environment, education, and fixity of purpose of the individual. It would be obviously unfair to compare a professional man or a brain-worker, whose units of work are intuitively manifold more than a hand-worker, and declare the latter a degenerate because his force and energy, as measured by the world's standard, are not as productive as the former. The questions of money standard and time-worth are foreign to the laws of degeneracy, and are not to be regarded in any way. The degenerate must be considered solely and alone upon the physical, mental, and abnormal stigmata which brand him as an abnormal or atypical man, and prevent him from exerting himself to the highest limit commensurate with his skill and development." The author's paper treats in detail of the various aspects of degeneracy.

Birds as Pest Destroyers.—The French journal, *Le Chasseur*, puts in a plea for the animals that should not be killed. "Why destroy spiders, except in rooms, while they check the increase of flies? Why tread on the cricket in the garden, which wars upon caterpillars, snails, and grubs? Why kill the inoffensive slowworm, which eats grass-hoppers? Why slay the cuckoo, whose favorite food is the caterpillar, which we do not like to touch? Why destroy the nuthatch and de-nest the warbler, foes of wasps? Why make war on sparrows, which eat seeds only when they can not get insects, and which exterminate so many grain-eating insects? Why burn powder against starlings, which pass their lives in eating larvæ and picking vermin from the cattle in the fields? (But they eat grapes too.) Why destroy the ladybird, which feeds on aphides? Why lay snares for titmice, when each pair take on an average one hundred and twenty thousand worms and insects for their little ones? Why kill the toad, which eats snails, weevils, and ants? Why save the lives of thousands of gnats by destroying goat-suckers? Why kill the bat, which makes war on night moths and many bugs, as swallows do on flies? Why destroy the shrew mole, which lives on earthworms, as the mouse does on wheat? Why say the screech owl eats pigeons and chickens, when it is not true, and why destroy it when it takes the place of seven or eight cats by eating at least six thousand mice a year?"

The Yang-tse-Kiang.—In a lecture before the London Foreign Press Association Mrs. Isabella Bishop describes the Yank-tse-Kiang as one of the largest rivers of the world, it draining an area of 650,000 square miles, within which dwell a population of 180,000,000. In the journey to the far East, the scenery at Szu-chuan changed from savage grandeur and endless surprises to the fairest scenes, with prosperity, peace, law, and order seeming to prevail everywhere. Erroneous ideas were often entertained about Chinese social life and surroundings. China had many trade associations, which were often strengthened by alliance with guilds. They were composed of men in any particular trade or employment, who bound themselves for common action in the interest of that trade. They might rightly be called trade unions, for through their elected officers they prescribed hours of labor and minimum wages and made trade rules, the breach of which was punishable by fine and expulsion. The Chinese people displayed much benevolence and social kindness one to another, and had societies for providing free coffins and seemly burial in free cemeteries for the poor, soup kitchens, foundling institutions, asylums, orphanages, and medical dispensaries. Throughout the whole of the Yang-tse basin the author was impressed with the completeness of Chinese social and commercial organization by the existence of patriotism or public spirit, by great prosperity, and by the absence of the decay often attributed to the nation. Of the prevailing "expansion" or territorial robbery fever Mrs. Bishop said that we were coming to think only of markets and territories, and to ignore human beings, and were breaking up, in the case of a fourth of the human race, the most ancient of the earth's existing civilizations without giving for our supposed advantage a fair equivalent.

"Somewhat" Poisonous Plants.—In Prof. B. D. Halsted's paper in the State Agricultural Experiment Station Bulletins on The Poisonous Plants of New Jersey, besides the descriptions of plants recognized as poisonous internally and to the touch, a list is given of "many somewhat poisonous plants." Among these the catalpa and ailantus produce emanations that are disagreeable and sometimes poisonous, and catalpa flowers, when handled, will produce an irritation of the skin. The thorn of the Osage orange leaves a poisoned wound. The young leaves of the red cedar and the arbor vitæ are irritating to the skin and may produce blisters, and the pitch of the spruce causes itching. Balm of Gilead may cause blistering. The green bark of the club of Hercules is irritating to the skin. The herbage of oleander affects some persons like poison ivy, the bark of the daphne causes blisters, and the juice of the box produces an itching with many persons. To some the herbage of the wild clematis is acrid and unpleasant. Many of the wild herbs have acrid properties, among them skunk cabbage, Indian turnip, cow parsnip, several of the mustards, and the juice of red pepper and stonecrop. Garden rue and the short bristles of the borage are irritating. Some persons have had their skin inflamed by handling the garden nasturtium. Other plants not always pleasant to handle are meadow-saffron bulbs, garlic, juice of bloodwort and celandine, the smartweed, the herbage of the poke, monkshood, larkspur, bearberry, some of the buttercups, anemone, star cucumber, various burs, daisy flowers, hairy plants, the nettles, sneezeweed, the corpse plant, and some of the toadstools. Flax spinners have a flax poison, jute workers a rash, hop pickers a disagreeable irritation of the hands, and the grinders of mandrake root find the powder irritating to the face. It is not unusual for persons who gather plants in field and forest to receive sensations akin to those produced by mosquitoes, which are often chargeable to the plants. Other animals than man are less susceptible to the effects of contact poisons.

The Dangers of Hypnotism.—In a review of the medico-legal aspects of hypnotism Dr. Sydney Kuh inquires whether the hypnotized can be injured physically or mentally by hypnotization, and whether they can fall victims to crime. Summing up a number of cases cited as bearing on the former question, he finds that hypnotism is now generally conceded to be a pathological and not a physiological condition; that its use, when resorted to too frequently, is liable to bring on mental deterioration; that it may be the cause of chronic headache or of an outbreak of hysteria; that at times it has an undesirable effect upon pre-existing mental disease; and that in some cases it may even produce an outbreak of insanity. He has learned of a few cases on record in which hypnotism was directly or indirectly responsible for the death of the patient. On the other hand, "we all know that hypnotism is a useful therapeutic agent practically only in cases of functional disease which only very rarely endangers the patient's life." Seeking simpler, less dangerous methods of treating maladies for which hypnotism has been recommended, the author has experimented upon the use of suggestion in the waking state, with results that encourage him. A large series of cases convinced him that a hypodermic injection of *aqua destillata*, given under proper precautions and circumstances, so as to impress the patient deeply, will produce very nearly, if not quite, as many cures as hypnotization. As for the other question, laboratory experiments indicate that a hypnotized person may be induced to commit acts bearing the aspect of crime, but that when the case becomes a serious one something will most likely occur in the mind of the patient or the conditions to prevent the consummation. The result is too uncertain and difficult, and the risks are too many and various, even to permit the use of hypnotism as an instrument of crime to become common or really dangerous. And the author's conclusion is that the dangers of hypnotism lie much more in its use for experimental and therapeutical than for criminal purposes.

Instruction of the Deaf and Dumb.—Of the two principal methods of instructing deaf-mutes in this country, as defined by Mr. J. C. Gordon, of the Illinois Institution, in the sign method, deaf-mutes are taught a peculiar language of motions of the arm and upper part of the body, to which they learn to attach signification through usage. For instance, to teach the word *cat* to a deaf child a sign teacher would show the child a cat or a picture of a cat. He would next direct attention to the cat's whiskers, drawing the thumb and finger of each hand lightly over them. "A similar motion of the thumb and hand above the teacher's upper lip at once becomes a sign for cat." After the sign has become familiar the child is trained to write the word cat on a slate, blackboard, or sheet of paper, and by frequent repetition the pupil associates the written word with the sign for cat, so that the written word recalls the gestural sign, and the gestural sign serves to recall the concept cat. This language is acquired more readily than any other means of communication. The other method is the intuitive, direct, or English-language method, and, while it would require the use of the living cat or the recognition of the picture of a cat by the deaf child, would connect the written or spoken word directly with the object, without the intervention of any artificial finger-sign. Wherever this method prevails the English language in its written or spoken forms, or in its finger-spelled form, becomes the ordinary means of communication between teachers and pupils, so that every step in instruction requires the use of the English language, which is practically both the instrument and the immediate end of instruction. All the schools called oral use this method. It can be used in connection with finger-spelling, but not with the sign method.

Experiments in Nature Study.—Some very interesting features of school children's Nature study—not the teaching of science, but the seeing and understanding of the common objects of the external world—are illustrated in a report of Cornell Agricultural Experiment Station, from incidents of school life in some of the New York schools. The children in the sixth grade of one of the schools of Saratoga Springs provided themselves with eggshells filled with earth and sown with wheat. "The botanical side was made a lesson well flavored with active interest. The pride of ownership and a plant coming from a spoonful of earth had the charm of a creation all the pupil's own, and it was much more real to study the thing itself than to read about it and make a recitation." Geographical applications were made by tracing the introduction and extension and transportation of the crop, and by means of the exchange of correspondence the wheat belt could be traced and plotted in every State of the Union. The children of Corning gathered seeds and divided them into classes as indicated by the means of travel with which they are provided. A small boy felt himself a profound investigator when he discovered the advantage some seeds have in being able to float and ride on the water. It required no hard drill to learn the names. The summer planting of flowers by the children of Jamestown resulted in a flower show in the fall. Many children took the tent caterpillar, reared it from the eggs, and learned all about its metamorphoses. "Nature study can be made elastic. In the kindergarten it can be idealized so as to approach a fairy story. It can be intensified so that in the high school it will have all the solidity of pure science."

The best proof that the idea is bearing fruit is that teachers are asking for definite instruction on the subject, and a course has been provided for them. The study should be so informal as not to admit of systematic examination.

Chemistry Teaching in Grammar and High Schools.—At the fourth meeting of the New England Association of Chemistry Teachers, held in Boston in January, 1899, preliminary reports were made on grammar-school and high-school courses in chemistry. The grammar-school course was defined as intended to give its pupils first-hand knowledge of the more obvious and important facts and principles of chemical changes, with emphasis placed on those facts which are illustrative of the changes that are going on all about the pupil in the home and in outdoor Nature. While the point of view should be that of Nature study rather than of science, the selection of material and method of study should be such as to make the course of greatest value to those who are to pursue the subject in higher institutions. For high-school study the report insists that, before everything else, the course be intelligible to the pupil. Whatever experiment or work is undertaken, it must be such that the pupil shall be able to understand its aim and the steps in its pursuit, and it must not be too intricate in demonstration or abstruse in application. It should require at least five hours a week, and, if possible, too, of these periods consecutive, and should come as late in the curriculum as possible, following physics. The general work may be divided into the heads of historical, informational (qualitative and quantitative), and theoretical, the second division having ordinarily the larger part of the time. The belief is expressed that only part of the demonstration work should be done by the teacher in the class, but most of it should be performed, as far as practicable, by each pupil in the laboratory. Lastly, the report recommends that the humanistic side of the science be made as prominent as possible. Whenever facts in chemistry can be related to human life or activity this should be done.

MINOR PARAGRAPHS.

In a recent report on the educational work of the Passaic (New Jersey) public schools, Superintendent F. E. Spaulding points out one of the worst faults of our present public-school system. "The true function of education is to foster and direct the growth of children, not to teach so many pages, rules, facts, or precepts of this subject or of that. And the one adequate rule of practice is constantly to meet the growing needs of this and that individual child, not to teach this class of children as a class. From this proposition there follows the corollary, which is amply substantiated in practice, that the time, order, method, and extent of presenting any subject can be rightly determined only by the interest and capacity of the child for whose benefit it is to be presented, not by the logic and practical importance of the subject itself."

Dr. Sir James Grant, of Ottawa, has been led, by his studies of the alimentary canal in its function of discharging the secretions of the various glands, to a high appreciation of the importance of its operation in connection with the elaborate and complex nervous system associated with it. It is reasonable, he believes, to suppose that the activity of these nerves is injuriously affected by noxious influences long before any evidence of organic disease appears, and that, hence, want of care in the digestive process can not and does not fail "to bring about results of a most telling chraacter in the very process of sanguinification." Believing that irregularities of the digestive process in the alimentary canal are more frequent than is generally supposed, he holds that "the internal sewage of the system" can not be too critically examined with a view of preventing the ill effect of toxic accumulations upon the nerve centers. "That the recently discovered neurones," he adds, "play an important part in the vitalizing of nerve energy is a reasonable deduction. A path is now open in which life, under ordinary circumstances, *may be prolonged*, provided no organic disease is present."

The courses in biology in the University of Pennsylvania have been arranged with reference to the needs of students who desire instruction in the biological sciences for general culture, as a preparation for teaching or original investigation, or as a foundation for the professional course in medicine. They include in the courses in arts and sciences the electives, the biology-chemistry group, and the botany-zoölogy group, each set including several classes; the four-year course in biology, which appeals particularly to students who wish to become teachers or to take up special work as investigators in biology, and the two-years' course in biology, which is designed especially for those who desire some systematic training in natural science before taking up the study of medicine. Both of these courses are open to men and women alike. An ample equipment is provided for the biological department in the shape of spacious class rooms and laboratories, a botanic garden, an herbarium, a vivarium, zoölogical and auxiliary collections, a marine laboratory at Sea Isle, New Jersey, tables at Woods Holl, library facilities, two serial publications, and clubs and societies.

We learn from the London Lancet that besides the special ward of twelve beds at the Royal Southern Hospital of Liverpool, which was formally opened by Lord Lister on April 29th last, arrangements have been completed for a school for the study of tropical diseases at Liverpool. Lord Lister, on the occasion of the school's foundation, said: "The medical student in the ordinary hospital has rare opportunities of seeing these diseases, and for a man who is about to practice in the tropics it is essential that he have opportunities for studying them here before embarking on his tropical career. The possession of tropical colonies makes such institutions in the home country very necessary, not only for preparing the colonial doctors, but for the protection of the home population, which is sure to be brought into contact more or less with the infectious tropical diseases."

An interesting paper by Mr. C. J. Coleman on The Electrical Protection of Safes and Vaults is described in the Electrical World and Engineer. He divided the methods into two systems, in one the alarm depending on the opening and the other on the closing of a circuit—the latter of the two being the one most in use. Among the curious devices mentioned are cementing narrow tin-foil strips on the inner surfaces of window glass, so that any breakage or fracture of the glass will open the circuit; the use of glass tubes filled with mercury and connected in circuit, or tubes filled with water or compressed air. In reply to questions as to the use of electricity in perforating safes it was stated that a five-ply chrome steel safe, seven inches and a half thick, was burned through by three hundred ampères in twenty-five minutes, and holes were burned through a solid block of vault steel twelve inches thick in twenty-six minutes with three hundred and fifty ampères, and in fifteen minutes with five hundred ampères.

NOTES.

The Royal Institution of Great Britain, on the occasion of its one hundredth anniversary, has elected as honorary members the following Americans: Prof. Samuel Pierpont Langley, astronomer, Secretary of the Smithsonian Institution, Washington, D. C.; Prof. Albert Abraham Michelson, physicist, of Chicago; Prof. Robert Henry Thurston, mechanical engineer, Director of the Sibley College of Cornell University; Prof. J. S. Ames, of Johns Hopkins University; George Frederick Barker, physicist, Professor of Physics at the University of Pennsylvania, Philadelphia; and Prof. William Lyne Wilson, President of Washington and Lee University, ex-Congressman, and Postmaster-General.

The foundation stone of an oceanographic museum, instituted by Prince Albert of Monaco, was laid in that city April 25th. The museum is designed, primarily, to receive the large and valuable collections obtained by the prince in the voyages of ocean exploration which he has conducted, and to become a general depository for oceanographic spoils. The principal address was made by the governor-general, who glorified the prince's meritorious scientific career. The German Emperor, who is named a patron of the museum, and the French President were represented on the occasion by deputies.

The City Library Association of Springfield, Mass., has been holding, during April, May, and June, an elaborate and instructive exhibit of geographic appliances of special interest to teachers in the elementary schools. The exhibition included a number of sets of wall maps, relief maps and globes, models for use in structural geography, pictures, photographs, etc., of geographical features, aids in teaching, geographical texts, manuals and treatises, books of travel, and an exhibit of geographical work done in the elementary schools of Springfield and vicinity. The association has also published a brief Bibliography of Geographical Instruction, which was prepared by W. S. Monroe, of the State Normal School at Westfield, Mass.

Dr. Daniel G. Brinton has presented to the University of Pennsylvania, where he is Professor of American Archæology and Linguistics, his entire collection of books and manuscripts relating to the aboriginal languages of North and South America. The collection represents the work of twenty-five years, and embraces about two thousand titles.

Mr. Andrew Carnegie has offered to complete, with a contribution of £50,000, a fund which Mr. Joseph Chamberlain is trying to raise in order to make the scientific school the principal department of the University of Birmingham, England.

A noteworthy experiment in bird protection has been made in a boys' school at Coupvray, France, by forming a society of the pupils for that purpose. The president, vice-president, and secretary of the society are selected from among the pupils of the first division, and all the other pupils are members. Meetings are held every Saturday afternoon in March, April, May, June, and July, under the presidency of the teacher, to hear the reports of members and record the nests protected and noxious animals destroyed in a notebook kept for the purpose. In 1898, 570 nests were protected by the school, and more than 400 mice, rats, weasels, and dormice were destroyed. Such societies cost nothing, and are capable of rendering great service.

Ernest D. Bell, whose formula for determining animal longevity by the length of the period of maturity was published in a recent Monthly, has sent a later communication to Nature, changing his constant from 10.5 to 10.1, the latter figure giving much better results.

The report of Mr. J. C. Hopkins on the Clays and Clay Industries of Western Pennsylvania is the second one of a series of economic reports on the natural resources of the State in course of publication by the Pennsylvania State College. The first report, published in 1897, was on the Brown Stones of Pennsylvania. The report represents that a capital of nearly $7,000,000 is invested in the clay industries about Pittsburg, of which more than $3,000,000 are in the fire-clay industry. The value of the annual output of material is nearly $4,000,000, more than fifty per cent of the capital invested. The 139 companies employ 4,403 men.

Herr Hansemann, of the University of Berlin, who examined the skull of Helmholtz, reports in the *Zeitschrift für Psychologie* that he found the head about the size of Bismarck's, and a little smaller than Wagner's. By metrical standards the brain weighed about 1,700 grammes with the coagulated blood, and about 1,440 grammes without it—about 100 grammes more than the average. The circumvolutions, which are now thought to have more relation to mental capacity than mere weight, were particularly deep and well marked. The skull was 55 centimetres in circumference, 15.5 centimetres broad, and 18.3 centimetres long, and the cephalic index was 85.25.

Our obituary list for this month includes the names, among persons known in connection with science, of Miss Elizabeth M. Bardwell, Professor of Astronomy in Mount Holyoke College, who died May 28th, aged sixty-seven years; G. F. Lyster, long Engineer-in-Chief of the Mersey Docks and Harbor Board, and author of valuable improvements in the Liverpool docks, member of the Royal Society of Edinburgh and of the Institute of Civil Engineers, aged seventy-six years; Prof. Lars Fredrik Nilson, Director of the Agricultural Experiment Station at Stockholm, Sweden, May 14th, aged fifty-nine years; M. Adolphe Lageal, a French geologist, killed by natives while making explorations in the French Soudan; Sir Frederick McCoy, Professor of Natural Science in the University of Melbourne, died in May, aged seventy-six years; he was a member of the Geological Survey of Victoria, founder of the Melbourne National Museum, and author of numerous papers on Victorian geology; before going to Australia he was Professor of Geology in Queen's College, Belfast, and had already attained a high reputation as a geologist by the work he had done as assistant to Sedgwick and by the publication of important memoirs in geology and paleontology; and Lawson Tait, an eminent English surgeon, author of numerous books of a high order relative to his profession, and an active worker in practical sanitary matters; he died at Llandudno, Wales, June 13th, aged fifty-four years.

EDUARD OSCAR SCHMIDT.

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ARE WE IN DANGER FROM THE PLAGUE?

By VICTOR C. VAUGHAN,
PROFESSOR OF HYGIENE IN THE UNIVERSITY OF MICHIGAN.

IN an article on the plague in this journal, in May, 1897, the writer answered this question as follows: "Yes, there is danger; but this, being foreseen, may be easily avoided. Thorough inspection of persons and disinfection of things from infected districts will keep the disease out of Europe and America. Only by the most gross carelessness could the plague be permitted to enter either of these continents."

It will be of interest to take up this subject again, and study it in the light of the history of the plague since the article referred to was written. The plague first appeared in western India, at Bombay, where it still prevails. We are without any exact information concerning its introduction into that city. Before the outbreak of the disease at Bombay the mortality had increased so markedly that it was a subject of discussion for three meetings of the Grant Medical Society. The increase was attributed to the filthy condition of the streets. This society made an investigation of the increased mortality, and presented a report on the same to the municipal authorities. Instead of heeding the warning, the authorities jeered at the society, and refused to allow the report to be read.

Dr. Viegas appears to have been the first physician to recognize the existence of the plague in the city. In a paper read before the Grant Medical Society on November 24, 1896, he discussed the possible and probable avenues by which the disease had found its way into the town. He stated that sugar and dates had been mentioned as means by which the plague was imported, but, if this had been the case, he thought it strange that the infection had not been conveyed from Bagdad and Bassorah, inasmuch as these articles come almost exclusively from those places. Again, it was thought possible that the clothes of the sick or of the dead from the plague in China might have been brought over to Bombay, but Dr. Viegas was unable to find any evidence in support of this theory. It had also been claimed that rats sick with the plague had come by ship from Hong Kong, and had infected the rats about the docks in Bombay. This theory, Dr. Viegas held, was not supported by any facts. In short, Dr. Viegas found some objection to every theory that had been proposed, and leaves us in doubt as to his own views concerning the avenue by which the plague reached Bombay. He is quite confident, however, that the filthiness of the city is to blame for the rapidity with which the disease spread.

In a report by Lieutenant-Colonel Weir on the plague in Bombay a statement is made that the disease was imported from Suez. Early in September, 1896, four very suspicious deaths were reported, but, as none of these had been attended by medical men, no definite conclusion could be reached concerning them. The first case was reported by Dr. Viegas late in September, 1896. The patient was a native who had not been out of the city for months. The first case reported among Europeans occurred on November 12, 1896. During the winter of 1896 and 1897 the disease prevailed most alarmingly, and reached its highest mortality during the week ending February 9, 1897, when the deaths from all causes in Bombay numbered 1,891. During the summer of 1897 the disease declined, and led to the belief that the measures that had been put in operation would prove successful. This hope, however, was not realized, and during the winter of 1897 and 1898 there was a recrudescence of the disease. During the summer of 1898 the disease again abated, to appear with renewed strength during the winter of 1898 and 1899. During the last week in March, 1899, the total number of deaths from all causes in Bombay reached 2,408, and the deaths from plague alone numbered more than 250 a day. It will be seen from these figures that the plague still rages with undiminished virulence in the capital of western British India. The abatement of the disease during the summer months and its increased severity during the colder season are not directly due to the effects of temperature. In the warm season many of the natives sleep out of doors, while during the colder weather they crowd into small, unventilated, filthy rooms. It is the opinion of practically all observers at Bombay that the recrudescence of the disease during the winter is due to this overcrowding.

Since the plague has prevailed at Bombay for nearly three years, it may be well to inquire concerning its probable continuance at that place. In making this inquiry we may learn something of the sanitary condition of the city and the habits of its inhabitants. Bombay is the metropolis of western India, and is situated on a long, narrow island running almost north and south. The city is located near the southern end of this island, with its harbor to the east and its sewage outfall to the west. Its population of about nine hundred thousand is a very mixed one, consisting of Hindoos of different castes, of Mohammedans, of Eurasians, and of Europeans. Differences in race, in religion, and in caste make it exceedingly difficult to carry out sanitary measures and to look after the sick. The mean temperature is about 79° F., and the relative humidity seventy-seven per cent. A considerable portion of the island is below high-water level, and consequently the sewage must be removed by means of pumps. The mean maximum temperature of the ground eleven feet below the surface is 84.9° F., and the mean minimum temperature is 80.9° F. It will be seen from these figures that organic matter must undergo rapid decomposition both on the surface and in the sewers. The water supply, which is said to be excellent, is so carelessly drawn upon by the natives that, although sufficiently abundant if used properly, it sometimes becomes scant. It not infrequently happens that the sewers will not carry the volume of water turned into them. For this reason, together with the tropical rains, the soil often becomes water-logged. Indeed, the surface in some sections of the city may be, not inappropriately, compared with a fermenting muck-heap. Besides the fixed population, there is a constant current of people flowing to and fro between the island and the mainland. When there is any opportunity for the employment of a large number of unskilled laborers, hundreds and thousands from the surrounding country pour into the city. These people know nothing of sanitary appliances, they lodge in the most densely crowded parts of the city, and often a dozen of them will hire a single room, not more than ten feet square, in which they eat and sleep. It is said that seventy per cent of the inhabitants of Bombay live in "chawls." These are tenement buildings of from five to seven stories high, built on the "flat" system. A narrow hall, at the end of which is a latrine, runs through each story, and from this doors open into rooms eight by twelve feet in area. In one of these houses from five hundred to eight hundred people live. These buildings are crowded together, with only narrow, dark alleys between. Into these alleys the inhabitants of the houses on both sides throw all kinds of refuse. In many parts of the city fecal matter is deposited in boxes or baskets, and these, when filled, are carried on the heads of scavengers to certain designated places and the contents dumped into the sewers. It may be of interest to note, in passing, that these scavengers seem to be largely immune to the plague and all other infectious diseases.

This is a brief description of the sanitary condition of the city into which the bubonic plague found its way nearly three years ago. How long is it likely to remain? Before attempting to answer this question we might ask what means have been employed to eradicate the disease. On October 6, 1896, the municipal health commissioner issued an order to the effect that all cases of the plague were to be segregated, their houses disinfected, by force if necessary, and their sick to be taken to the hospital. Health inspectors visited all parts of the city, and carefully went through the great tenement houses looking for those sick with the plague. When such were found they were immediately sent to a hospital. Later, four camps were prepared, with facilities for accommodating about twenty thousand people. An attempt was made to transfer all the residents from a certain section of the city to these camps, and detain them there while their residences were being disinfected. After this had been done these people were allowed to return to their homes, and another twenty thousand were taken to the camps. This attempt, however, was never fully carried out. A high-caste Hindoo prefers death at any time to association with one of inferior caste. Every attempt at segregation of the sick led to more or less disturbance; and finally, in March, 1898, serious riots resulted. These were begun by Mohammedans, who followed a medical officer to the hospital and burned the building and hospital supplies. A plague inspector and three English soldiers were stoned to death. Since the riots attempts at segregation of the sick have been practically abandoned. Numerous hospitals have been provided, in order that those differing in religion or in caste might be cared for at different places. Under certain restrictions those sick with the plague are allowed to remain in their homes. It will be seen from these statements that it is not probable that the plague will be driven by human agency out of Bombay. The Hindoos believe that when the plague finds its way into a city it will remain for six years. The probabilities are that this belief will be strengthened by the history of the present epidemic in Bombay. Nothing short of an extensive conflagration, destroying a large part of the city, can thoroughly disinfect this place, in which the plague has already dwelt for nearly three years. I think, therefore, that we must conclude that it is quite certain that for several years yet Bombay will remain an infected city.

When the plague was first announced at Bombay a large number of its inhabitants, estimated at about three hundred thousand, left the city. There can be but little doubt that with these the germs of the plague were carried into the surrounding country. From Bombay the disease has spread out in every direction, until it has found its way into nearly every part of India. To-day the three large commercial cities of British India—Bombay, Calcutta, and Madras—are all infected. The manner of the introduction of the disease into Calcutta is somewhat uncertain, several different accounts being given as authentic. Dr. Cantlie says on this point: "The first case dealt with and reported upon in Calcutta gives an interesting history. The patient, a lad seventeen years old, came from Bombay, where evidently he had been exposed to infection, as his sister, who accompanied him, had seen several cases of plague in Bombay. Fifteen days before leaving Bombay he had noticed swelling first in one groin and then in the other, but never felt ill until his arrival in Calcutta, on September 24th. He was seen and carefully examined in Calcutta by honest observers, and a diplobacterium identical with the Kitasato bacillus was found in his blood. Not only so, but the clinical symptoms of plague were most manifest."

Another authority would have it that the plague was brought to Calcutta from Hong Kong by a British regiment which had been engaged in cleansing infected houses at Hong Kong. On this point Dr. Simpson makes the following statement: "In January, 1895, the regiment went to Calcutta, and this disease was first diagnosed as syphilis, then as malarial fever with bubo, and finally the cause was declared to be unknown. In June, 1896, one of the medical officers of the regiment was attacked with fever, and the glands of the neck, axilla, and groin were all enlarged. A goodly number of similar cases were met with in the town; moreover, the rats became sick, and the grain stores swarmed with diseased and dead rats. In spite of opposite evidence, it was well-nigh certain that plague in a sporadic form had been in Calcutta since 1895 or 1896."

The bacillus of the plague has undoubtedly found Calcutta quite as well prepared for its reception as Bombay. In discussing a medical report on the sanitary condition of Calcutta, the Pioneer Mail makes the following statement: "London, with its population of over 4,000,000, has about 36,000 people to the square mile. In the thirteen wards of Calcutta there are only four below this figure; the remainder have from 46,000 to 144,000 per square mile, three wards containing actually over 100,000. Colootolah is most densely populated; the houses are literally crammed with people. One case is quoted where 250 persons were living in a space that should accommodate only 50. In a hut seven feet in length, breadth, and height five men were found, and several instances are given where similar conditions obtained. In our barracks 600 cubic feet per man is the minimum space allowed. In these *bastis* the space runs from 157 to 49 cubic feet. This would be bad enough if everything were clean and sweet in and about the huts, but, as the medical board puts the case, 'here we find an allowance per head going as low as practically one thirtieth of that given in barracks, and no ventilation, with filth *ad libitum* both in the room and in its surroundings, to say nothing of the filthy persons of its occupants, the sewage in the adjacent drains, and the accumulated filth in the neighboring latrines; and to this may be added the fact that the subsoil on which the huts are built is soaked through and through with sewage matters and littered with garbage and filth of all kinds.' The narrow gullies which give access to these huts are in keeping with the general character of the *bastis*, and we may well wonder that epidemic disease is not always present."

The probabilities are that the plague will continue in Bombay, Calcutta, and Madras until it dies out from want of susceptible material. It is not at all likely, with the conditions in these cities, such as have already been described, that sanitary measures sufficiently energetic to destroy the bacillus will be resorted to. For some years to come these cities are likely to harbor the infection, and will remain, as they are now, nurseries for the disease.

The plague has not confined itself to the large cities of India, but has spread all over that country. It has extended into the northwestern provinces, has crossed the frontier, and passed into Baluchistan and Afghanistan. In many of the interior cities it has proved quite as fatal, in proportion to the population, as at Bombay and Calcutta. At Poonah the mortality has during some weeks been as high as eighty per cent of the cases, and four hundred deaths a week have been reported. At Sholapore, in the Punjab, far to the northwest of Bombay, the disease has prevailed in epidemic form.

With the plague widely diffused over the Indian empire, what measures have been taken to prevent its spread to other parts of the world? There are two routes by means of which the disease may pass from India to Europe. One of these is by ship through the Red Sea, the Suez Canal, and the Mediterranean; the other is overland from the northwestern provinces of India through Afghanistan into southeastern Europe. In fact, there are three overland routes from northwestern India into Europe. One of these leads from Lahore, the capital of the Punjab, through Afghanistan into the Transcaspian Province of Russia. The Transcaspian Railway extends from Samarkand, a place of about thirty-five thousand inhabitants, through the desert to the Caspian Sea at Ouzoun Ada. The latter place is connected by steamer with Baku and the Russian railroad system. The second overland route starts from the north-western provinces, or Afghanistan, or Baluchistan, passes through Persia, extending on up between the Caspian and Black Seas, and crosses the Caucasus Mountains in the neighborhood of Tiflis. Both of these routes are quite extensively traveled and pass through cities of considerable commercial importance. Samarkand has extensive manufactures of cotton and silk, and carries on considerable trade by means of the Transcaspian Railway with European Russia. The second route passes through Teheran, the capital of Persia, with a population of about two hundred and twenty-five thousand. This route is also largely employed by commercial travelers, especially from Russia. The third overland route passes through Persia and Turkey in Asia up to Constantinople. This route can not be called a commercial highway, but it is used to a considerable extent, especially by pilgrims, and since at no point do travelers along this route come in contact with European guards against the plague, it is most likely that the pest will find its way into Constantinople by this avenue, if at all. The first two overland routes are guarded by Russian medical inspectors. Russia has not been slow to protect itself against the introduction of this epidemic. In December, 1896, the following lines of action were determined upon, and have apparently since that time been carried out quite thoroughly: First, Russian medical men were sent to the larger cities of Persia, such as Teheran and Meshed, for the purpose of watching the approach of the plague. All Russian consular officers in Persia were requested to inform these medical men of every rumor of the epidemic. Second, points of embarkation on the Persian shore of the Caspian Sea have been watched, in order to detect suspicious cases that might pass to Russia along this route. Third, observation stations have been established along the frontiers of the Transcaspian Province. Inspection officers stationed at these places have been notified to close the frontier, with the exception of certain points where inspection stations have been established. Fourth, inspectors have also been placed to guard the region of Tiflis against the introduction of the plague from both Persia and Turkey. For the reasons above mentioned, it seems to me probable that if the plague reaches Europe, it will likely do so by way of Turkey in Asia, across the Bosporus into Constantinople. The large number of pilgrims passing along this route, with the Turk's well-known fatalistic belief, render it quite probable that infection gathered anywhere along the route may be carried into Europe. Since several places in Hedjaz, along the eastern shore of the Red Sea, have already become infected with the plague, it is by no means improbable that the disease may find its way into the Balkan Peninsula. There are also several centers of infection along the shores of the Persian Gulf. It will be seen from these statements that Mohammedan pilgrims are exposed to the infection. Indeed, already the disease has been detected among these pilgrims on steamships in the Red Sea.

Certain international measures for the restriction of the plague were formulated at the Sanitary Convention of Venice in 1897. Nearly all civilized nations sent representatives to this conference, and certain general rules were adopted. Recognizing the fact that Mohammedan pilgrims from infected districts in India, coming to Mecca and other places along the eastern shore of the Red Sea, would mingle with those of like faith from Turkey and northern Africa, special rules concerning pilgrims were adopted at this conference. It should be understood, however, that these rules are likely to prove efficient safeguards only among those pilgrims who travel by sea. In the first place, the conference made certain regulations concerning the construction and sanitary arrangements of pilgrim ships. The upper deck must be kept clear for these people, and on the main covered deck every pilgrim has to have at least sixteen square feet of surface. Every one embarking on a pilgrim vessel must pass a medical inspection. No sick person or one suspected of having an infectious disease is allowed to go on board. The number which the vessel is allowed to carry is determined beforehand, and the names of all passengers and their home residences are recorded. The ship must supply wholesome water and make provision for food, proper in quality and sufficient in quantity. Every vessel carrying pilgrims must have on board a medical officer and a disinfecting stove. Details are given concerning the sanitary regulations during the voyage. All pilgrims are landed on the island of Camaran, in the Red Sea, before being allowed to disembark on the last stage of their journey. The period of detention from healthy ships at this place extends through only three days. If no disease appears during this time, the pilgrims are allowed to embark again, and go directly to Jeddah. If disease appears either before or after landing at Camaran, the pilgrims are detained at least ten days from the date of the last case. Arriving at Jeddah, they are no longer under international sanitary regulations, and any control exercised over them at that time must be administered by Turkish authorities. Just here, in my opinion, lies the greatest danger so far as pilgrims are concerned. It is true that the conference made certain recommendations and formulated certain rules concerning the return of those pilgrims going to the north or into Egypt, but the fact must not be overlooked that these restrictions are applicable only to those who go by sea. No restrictions are placed upon Mohammedan pilgrims returning from Mecca to India. India is already so generally infected that such restrictions have been deemed unnecessary.

The following is a general statement of the rules applicable to vessels coming to European ports from India through the Suez Canal: All vessels that have been ten days or longer at sea after departure from an infected port are allowed to pass through the canal without question and without precaution. Suspected vessels or those which have been at sea less than ten days since departure from an infected port, and which are provided with a medical officer and a properly equipped disinfecting plant, are allowed to pass through the canal in quarantine. This means that while passing through the canal there shall be no communication between those on board the vessel and those on the land. Other suspected vessels are compelled to proceed to the Wells of Moses for disinfection. Here the passengers and crew are disembarked, isolated for twenty-four hours, and their effects disinfected. At the same time the contents of the ship undergo disinfection. If the plague be found on board, all passengers, as well as the crew, are detained for a period not exceeding ten days. All clothing, the cargo, and the ship itself are disinfected. When a vessel passes through the Suez Canal in quarantine, notice of that fact is telegraphed to the country to which the vessel is going, and it is not allowed to land elsewhere.

Should the plague appear in any European country, the following rules were formulated to prevent its spread: (1) Whenever a case of the plague appears in any country the sanitary authorities of that country must give immediate notice to all other countries represented in the conference. This notice may pass through diplomatic or consular agencies, or it may be sent directly by telegraph. After this the sanitary authorities of the country in which the plague has appeared shall inform other countries at least once a week concerning the progress of the disease and the measures resorted to to prevent its spread.

(2) When an infected person enters a country by rail or other conveyance overland, disinfection of his person and personal effects is made obligatory. Land quarantine is condemned, and it is recommended that modern disinfection be practiced in its stead. Each country, however, may reserve the right to close its frontier against any other country in which the disease exists. It is recommended that medical inspection along the frontier be established in con-

nection with custom-house examinations, in order to prevent unnecessary delay in travel. Passenger trains and postal cars are not to be detained at any frontier, but if a car be found to contain a real or a suspected case of the plague, this car shall be detached from the train at the frontier or at the nearest station thereto and its contents disinfected.

(3) Travelers coming from infected countries may be, at the discretion of the sanitary authorities, detained under observation for a period not exceeding eight days. Individual governments are allowed to take any special measures that may be deemed wise against the importation of the disease by means of gypsies, vagrants, and immigrants.

In formulating the above-mentioned rules to prevent the importation of the plague into Europe the members of the Venice Congress seem to have been thoroughly convinced that the longest period of incubation possible in this disease is ten days. It seems to have been assumed that if a vessel had been for ten days or longer at sea after departure from an infected port, and no cases of the plague had developed up to that time, there could be no danger of this vessel carrying the infection. It appears to me that a safer course would have been to require inspection of all persons and things going on board a vessel leaving an infected port, and the thorough disinfection of certain things, at least, on such vessels arriving at uninfected ports. The disinfection of a ship and its cargo by means of steam is not at present a very costly procedure.

Since the plague, if it reaches America at all, must come to us by sea, it may be of special interest to inquire concerning outbreaks of this disease on board ship. In making this inquiry we will confine ourselves to such cases as have occurred within the past two years. In March, 1897 (I have been unable to ascertain the exact date), the transport Dilwara left Bombay, bound for Southampton, with a regiment of English soldiers, together with their wives and children. On March 18th, while the vessel was in the Red Sea, a child died of the plague and was buried at sea. On arriving at Suez the persons who had been in immediate contact with the child were transferred to the Wells of Moses and properly disinfected. After this had been done, the vessel was allowed to pass through the Suez Canal in quarantine. No fresh case occurred, and the vessel arrived at Southampton April 6th. Here all articles which might possibly contain infection were disinfected, the passengers were allowed to go to their homes, and the troops were placed in barracks. No other cases resulted.

On July 6, 1897, one of the crew of the Carthage, of the Peninsular and Oriental Company's line, was attacked with the plague.

The ship was then in the Arabian Sea. Two days later the sick man, with two other members of the crew detailed to attend him, was landed at Aden. Six days later a second member of the crew was attacked with slight symptoms of the plague. This fact was reported when the vessel passed Malta. The Carthage had intended to stop at Marseilles, but, on account of the plague on board, continued its course to England. Both of these patients were isolated by being placed in a large boat hung at a height at the side of the vessel so as to avoid communication with others on the ship. When the vessel arrived at Plymouth the passengers were allowed to depart to their respective homes. The only precaution that was taken consisted in ascertaining the destination of each person, and informing the health authorities of the places to which these people were going. The Carthage had on board a steam disinfector, and everything that had been exposed to the infection was thoroughly disinfected. On arrival at the port of London the second patient was isolated until he recovered. No cases developed in England.

On December 7, 1897, the Caledonia arrived at Plymouth, England, from Bombay, without touching at any Mediterranean port. While in the Red Sea two lascars developed symptoms of the plague. They were landed at Suez, and no further outbreak occurred. When the ship reached Plymouth one hundred and sixty passengers were landed, and their names and addresses forwarded to the local authorities of their respective destinations. After proper disinfection, the ship proceeded to London.

In December, 1898, a case of plague developed on the Golconda while at Marseilles, on her way from Bombay to London. The ship proceeded immediately, the patient was landed at Plymouth, proper disinfection was carried out, and no other cases developed. This is a proof that the assumption that a vessel is safe from infection after ten days have passed since leaving an infected port is fallacious, as this time was exceeded between Bombay and Marseilles.

The report that the Nippu Maru recently arrived at San Francisco with the plague on board has proved to be erroneous.

In September, 1896, a Portuguese-Indian steward died at the Seamen's Hospital, at Greenwich, England, very suddenly. This man was in the hospital for only forty-eight hours, and no one suspected the plague at that time. On the last day of October of the same year another patient in the same hospital was taken ill and died with symptoms of the plague. Bacteriological examinations of the glands of the body of the second man were made, and a bacillus which presented the well-known characters of the plague bacillus was found. The vessel on which the Portuguese steward came to England left Bombay about the end of August, 1896. There was at that time no official knowledge of the existence of the plague in Bombay, but it probably existed there. This is another evidence of the fallacy of the belief in the ten days' period of incubation. It seems quite evident to me that the English authorities lay too much stress upon the period of incubation. A man leaving Bombay or any other infected port may carry the bacillus under his finger nails, elsewhere on his person, or in his clothing, and may not become infected until many days after leaving the infected place. Careful inspection and thorough disinfection of all vessels coming from infected ports should be insisted upon. It has been abundantly demonstrated by the history of the plague, as well as that of other infectious diseases, that the old plan of detention in quarantine is a relic of bygone times. Detention is cruel, dangerous, and inefficient; inspection and disinfection are rational and efficacious.

The modes of infection with the bacillus of the plague are as follows: (1) By inoculation. The history of the present epidemic in Asia recounts several instances of inoculation with the plague bacillus. On June 22 or 23, 1896, while making a post-mortem examination, Professor Ayoama, of Tokio, one of the Japanese commissioners sent to Hong Kong to study the plague, scratched the third finger on his left hand; on June 27th he again scratched himself on the end of the right thumb; on the evening of June 28th he felt ill, and had a temperature of 101.6° F.; he slept well during that night, but during the afternoon of June 29th he had a temperature of 105° F. At that time a bubo was found in the left axilla, and there was well-marked lymphangitis of the right arm. Professor Ayoama has described his own case as follows: "On June 28th, after having finished a dissection, I took my meal about half past two and did not enjoy it. After the meal I went upstairs, when at certain movements of the arm I felt a slight pain in the left armpit, and on feeling with my finger I found some slightly enlarged glands present. In the evening I felt very ill, depressed, and languid, burning hot along the whole of the back, while the thermometer showed normal temperature. As Mr. Kitasato and I had invited guests that evening, I was present at supper. I had no appetite, and felt so languid that I often wished to withdraw. At half past eleven I hurried to my room, when I found my temperature was 39° C. I took one gramme of quinine, and slept well. Next morning I awoke and noticed, on the under side of the left ring finger, a small, whitish-yellow blister, and then, along the back of the hand, a red line. From this time I remembered nothing for more than two weeks."

Dr. Ishigami, another of the Japanese commission in Hong Kong, also inoculated himself with the plague while making a post-mortem examination.

A patient, while delirious with the pneumonic form of the plague, expectorated into the face of an English nurse caring for him. Within a few hours the eye on that side of the face became inflamed; later the parotid and cervical glands became involved, and the nurse died. Other illustrations of inoculation with the bacillus of the plague might be given. Dr. Wyssokowitch and Dr. Jobobat believe that the bacillus can penetrate the unbroken skin. In support of this belief they report some experiments made by them upon macaque monkeys. They found that when a needle was dipped in the culture of the plague bacillus and drawn across the palm of the hand of one of these monkeys, without making any visible scratch, the animal speedily developed the disease. However, this does not prove that the bacillus will penetrate the unbroken skin of man.

(2) By inhalation. That the pneumonic form of the plague results from inhalation of the bacillus can not be doubted. Monkeys caused to inhale the bacillus develop this form of the disease.

(3) By deglutition. That the disease may be acquired by taking the bacillus into the alimentary canal has been demonstrated by experiments upon animals of various kinds.

The sputum of patients suffering from the pneumonic form of the disease is filled with the bacilli. The germs are also found, sometimes at least, in the discharges from the bowels and kidneys. That the infection may be transported in clothing and rags has been long known. The following extract from a memoir by Sir John Hay, then minister from England to Morocco, indicates that the plague was introduced into Morocco in 1826 by means of infected articles of clothing: "The danger from plague by contagion can not, however, to my mind be called in question. That dire disease was introduced into Morocco about the year 1826 by an English frigate, which our Government had dispatched to Alexandria, where the plague was then raging, to convey from that port to Tangier two sons of the Sultan, returning from a pilgrimage to Mecca. No case of plague or other illness had occurred on board the frigate during the voyage, and the Sultan's sons and other passengers were allowed to land at Tangier.

"The customs officers, being suspicious that, in the numerous boxes brought by the pilgrims who had been permitted to embark with the Moorish princes, contraband goods were being smuggled, caused some of the cases to be opened. One contained Egyptian wearing apparel, which the owner said he had bought second hand,

and subsequently confessed had belonged to a person who had died of the plague in Alexandria. The two Moorish officials who opened the boxes were attacked with the plague that night and died in a few hours. The disease spread rapidly throughout Morocco, carrying off eighty per cent of those who were attacked."

I mention these facts in order to emphasize the desirability of disinfecting all articles liable to carry the infection coming from infected places.

Professor Haffkine's preventive inoculation against the plague is still being largely employed in India. This consists in injecting hypodermically sterilized cultures of the bacillus. No curative action is claimed for this treatment, but it is believed to be protective against the disease. It is stated that more than eighty thousand people in India have undergone this form of vaccination, and that the death rate among these has been exceedingly low. However, it is well to be careful in accepting statistical statements on a matter of this nature. In the first place, it is probable that only the more intelligent will submit to vaccination, and these will also employ other means of protecting themselves against the disease. In the second place, there are many thousands of people exposed to the infection, or at least live in infected districts, who have never been vaccinated and who do not acquire the disease.

Three kinds of serum have been used as curative agents in the plague. In 1896 M. Yersin began the use of a specially prepared serum in China. The first cases treated with this preparation did unusually well, and it was hoped that most valuable results would follow from its more extended use. This serum is prepared after the manner of the antitoxine used in the treatment of diphtheria. That used most largely in India is made at the Imperial Institute of Experimental Medicine in St. Petersburg. Numerous physicians in India have reported upon the action of this serum, and none of them favorably. Very recently Dr. Clemow treated fifty cases with this serum, and compared them with fifty other cases treated without the serum. Every other case was selected for the serum treatment. The mortality was exactly the same in each group, forty patients out of fifty dying.

The second serum is that prepared by M. Roux, of the Pasteur Institute in Paris. This is practically the same as the preparation made by M. Yersin, and the results obtained are equally unsatisfactory. In 1897 the writer had the privilege of observing, both at Paris and at St. Petersburg, the preparation of these agents, from which at that time great results were expected. A third preparation is made by Professor Lustig, of Florence. I have been unable, so far, to find any detailed account of the method followed by Professor Lustig in preparing his serum. From all that I can learn, however, it is not a serum, but a sterilized bacterial culture; at any rate, Lustig's preparation has proved probably least valuable of all.

At present (July, 1899) the plague prevails throughout India, and has appeared at various places in Baluchistan and Afghanistan, at Samarkand in the Transcaspian Province of Russia; in Persia, at Bassorah and other points along the Persian Gulf; at several places along the western shore of the Red Sea; at Suez and Alexandria; at Tamatave, in Madagascar; at Port Lewis, Mauritius; at Penang, in the Straits Settlements; at Amoy and Hong Kong, China; and at numerous places in Formosa. For reasons already given, it will not be at all surprising should the recent report that the plague had appeared in Constantinople prove to be true. If it once reaches that place, it is more than likely that it will become scattered throughout the Balkan Peninsula. The sad death of Professor Müller and his laboratory servant, at Vienna, from the plague bacillus which Professor Müller brought from Bombay, shows the necessity for caution in handling the germ of this disease.

Are we in America in danger of the plague? I will have to answer this question very much as I did two years ago: "Yes, we are in danger; but this danger, being foreseen, may be easily avoided." In my opinion, our most vulnerable point is along the Pacific coast. With the plague at Hong Kong, it is possible that it may be transferred to Manila, and the transports bringing soldiers to this country may also bring the infection. However, I think the chances of this happening are small. The length of time required to make the voyage from Manila to San Francisco is so great that, with the infection on board, it would be almost certain to manifest itself before reaching our shores, and, knowing its presence on board a ship reaching San Francisco or any other point on the western coast, thorough inspection and disinfection will keep the disease out of this country. The probabilities are that for several years to come the larger cities of India, at least, will remain infected, and our sanitary authorities must be vigilant. The fact that, if the plague reaches us at all, it must come by sea, that a long voyage must be made before it can reach us, and that the disease will most probably appear on board ship before arrival at any American port—all these conditions are in our favor. The General Government should take upon itself the control of all measures to prevent the introduction of infectious diseases from without. Quarantine detention is a relic of ignorance of the true nature of infectious diseases. All transports and other vessels between Manila and this country should be provided with proper disinfecting apparatus. The Government should supply the Marine-Hospital Service with every needed equipment, and if this be done the plague can enter America only through incompetency in that service. There is another source of danger on our Western coast that must not be overlooked. The plague is now widely distributed in Formosa, which is under the control of Japan, and our intercourse with the last-mentioned country should be most carefully watched.

TUSKEGEE INSTITUTE AND ITS PRESIDENT.

By M. B. THRASHER.

TUSKEGEE is a county town in the State of Alabama, not far from Montgomery. It is near the center of that part of the South commonly spoken of as the "black belt," because the negro inhabitants there greatly outnumber the whites. The town is one of the oldest in the South. It is said, in fact, that when De Soto made his famous journey across that part of the newly discovered continent he found an Indian village of the same name on the site of the present town. Tuskegee is five miles from the main line of the Southern Railroad, with which it is connected at Chehaw by means of a narrow-gauge road.

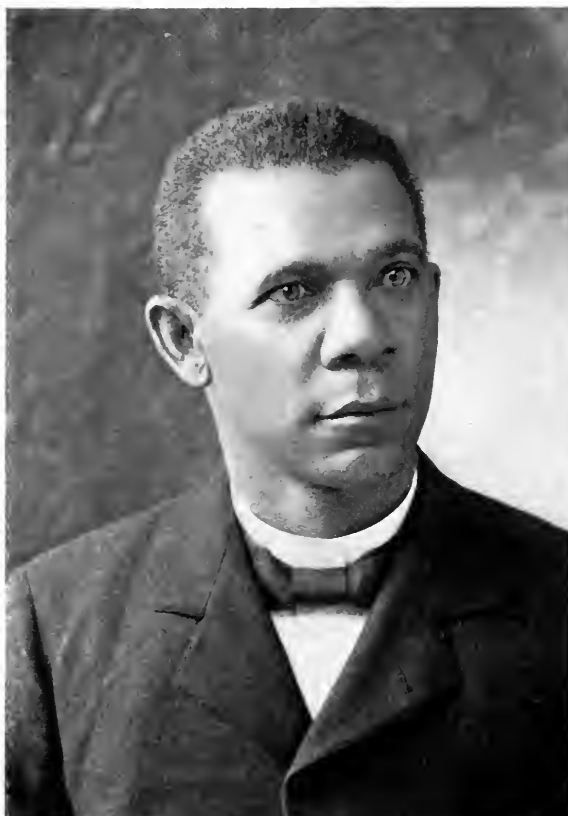
Tuskegee, as the word is oftenest used now, means the Normal and Industrial Institute, situated a mile out from the town and forming a little settlement in itself. This is the great school for young negro men and women which Booker T. Washington has built up, and of which he is the principal. The pupils who attend number a thousand each year. It is the largest school for colored people, managed by colored people, in the United States. There is no one connected with the school, except some of the members of the board of trustees, who is not of the race which the institute is designed to help.

Tuskegee Institute is so entirely the result of Booker T. Washington's labors, and his life has been so interwoven with the development of the school, that a brief account of his boyhood and youth is almost indispensable to a complete description of the institute, particularly as the conditions with which he struggled were so generally those which confronted all of the negroes at that time.

Booker T. Washington was born a slave in Virginia, not long before the breaking out of the war. It seems strange that a man who is so widely known to-day and is so universally respected as Mr. Washington, when asked how old he is should be obliged to reply that he does not know, yet such is the case. The birth of one more black babies on a large plantation at that time was a matter of too

The Faculty of the Tuskegee Normal and Industrial Institute.

little moment to have sufficient notice taken of it to accurately fix the date. He was a boy old enough during the war, though, to know something of the struggle going on around him, for, speaking in public of Lincoln once, I heard him say: "My first acquaintance with our hero was this: Night after night, before the dawn of day, on an old slave plantation in Virginia, I recall the form of my sainted mother bending over the bundle of rags that enveloped my body, on a dirt floor, breathing a fervent prayer to Heaven that



PRESIDENT BOOKER T. WASHINGTON.

'Massa Lincoln' might succeed, and that some day she and I might be free."

Another incident of those days I have heard him tell of in these words: "Word was sent over the plantation for all 'the hands' to come up to the 'big house.' We went, and to us men, women, and children gathered in the yard some one standing on the veranda read a paper. I was too young to understand why the men and women around me should have begun to shout, 'Hallelujah! Praise de Lawd!' when the reading was finished, but my mother, bending down to where I was clinging to her dress, whispered to me that we were free."

Not long after the close of the war the Washingtons left the plantation and went to West Virginia, where, in the coal mines, work could be had which would pay money wages. At first Booker worked in the mines with his brothers, but he soon became dissatisfied with the chance for improvement which that work afforded. "The first thing that led me to study," he has said, "was seeing a young colored man slowly reading a newspaper to a group of colored people who surrounded him with open mouths and gaping eyes. He was almost a god to them." The chance to study was soon found. An energetic woman of kindly nature hired the

Mrs. Booker T. Washington.

young colored boy to work about her house as a general chore-boy. Finding that he was anxious to learn, she offered to teach him to read in the spare minutes of his work, and did so. One day he overheard a man talking about Hampton, where General Armstrong had already begun his noble work. This, the man said, was a place where black boys could go to school, and at the same time work to pay their way. "As soon as I heard that," Mr. Washington has said, "I made up my mind that Hampton was just the place for me, and that I would go there. I started, although I had no money and did not even know where Hampton was. I felt sure I could inquire the way as I went, and work my passage. I walked a good share of the way, begged some rides, and when I had earned any money which I could spare, paid my fare to ride on the trains. I reached Richmond, Virginia, one night too late to get any work, and I was entirely out of money. While I was walking about wondering where I would get a lodging, I happened to see a nice dry place under a stretch of plank sidewalk. Watching my chance when no one was looking, I crawled in and curled up to sleep. The next day I was so fortunate as to get work helping to unload a vessel, and, as the job lasted several days, I came back each night to my lodging under the sidewalk, thus saving all my wages except the little required for food. In this way I was able to get money enough to carry me the rest of the way to Hampton, and leave me fifty cents when I got there."

ARMSTRONG HALL. One of the oldest buildings at Tuskegee.

In these days of entrance examinations to various institutions of learning, it is interesting to read of the examination which young Washington was required to pass before he could enter Hampton. He tells us of it thus: "Of course," says he, "they knew nothing of me, and, after my long tramp, days of hard labor and nights of sleeping in barns and under sidewalks, I suppose I could not have presented a very prepossessing appearance. After looking me over in a not very encouraging manner, they gave me a broom and took me into a room, which they told me to sweep. I suppose I swept that room over three or four times before I was satisfied to call it done, when a teacher came in and took her handkerchief and wiped the walls to see if she could find any dust on them. After that they said I could come to the school. So you see I passed my examination.

"At Hampton I found the opportunity, in the way of buildings, teachers, and industries provided by the generous, to get training in the class room, and by practical touch with industrial life to learn thrift, economy, and push. I was surrounded by an atmosphere of business, Christian influence, and a spirit of self-help that seemed to have awakened every faculty within me, and caused me for the first time to realize what it meant to be a man instead of a piece of property.

"While there I resolved that, when I had finished my course of training, I would go into the far South, into the 'black belt' of the South, and give my life to providing the same kind of opportunity for self-reliance and self-awakening that I had found provided for me at Hampton. My work began at Tuskegee, Alabama, in 1881, in a small shanty and church, with one teacher and thirty students, without a dollar's worth of property. The spirit of work and of industrial thrift, with aid from the State and generosity from the North, has enabled us to develop an institution of a thousand students, gathered from twenty-six States, with eighty-one instructors and thirty-eight buildings.

"I am sometimes asked what is the object of all this outlay of energy and money. To that I would answer that the needs of the ten million colored people in the South may be roughly said to be food, clothing, shelter, education, proper habits, and a settlement of race relations. These ten million people can not be reached by any direct agency, but they can be reached by sending out among them strong selected young men and women, with the

STUDENTS AT WORK ON NEW TRADES-SCHOOL BUILDING.

proper training of the head and hand and heart, who will live among these masses and show them how to lift themselves up. The problem that Tuskegee Institute keeps before itself is how to prepare these leaders."

The first time I went to Tuskegee I happened to ride for half a day through the State of Georgia in the same seat in the car with a man whose conversation showed him to be one of the class to whom the designation "unreconstructed" has sometimes been applied. An officer in the Confederate army, he had accepted the situation at the close of the war, but now, after thirty years, although he spoke of existing conditions without bitterness, he spoke of them with little or no sympathy. I had some doubt how he would comment on my errand, when I told him that I was on my way to attend the Negro Conference at Tuskegee. Imagine my surprise when he exclaimed: "Going to Tuskegee, are you, to see Booker Washington? Just let me tell you there's a man that's got the right idea of things. He's teaching the negroes to work. I wish the South had a thousand Booker Washingtons." This man, I learned afterward, when I was in Atlanta, was one of the most prominent and successful business men of that city.

The second day of my stay at Tuskegee, as I came out of the rude buildings where the conference had been held, a young colored man waiting at the door accosted me. "Is not this Mr. ——," he said, "and at the World's Fair were you not in charge of such an exhibit?" naming one of the educational exhibits. I said I was the man. "Don't you remember me?" he added, telling me where he had been working at the time. I did remember

Alabama Hall. One of the first buildings erected by the students.

him perfectly, and asked how he happened to be so far removed from Chicago.

"It was like this," he said. "Next year I went to the Atlanta Exposition. While there I heard Mr. Washington speak, and learned about his school where negro boys could learn a trade. I had always been at a disadvantage because I did not know how to do any kind of work really well. So I came here and began to learn carpentering. I have the trade nearly learned now, and when I graduate from here I shall know how to really work."

Soon after beginning my long car ride from Tuskegee back to the North I stepped into the mail car on the train to post some let-

Dairying Division; making Butter.

ters. The envelopes I had used bore the imprint of Tuskegee Institute in the corner. As I handed them to the postal clerk, he glanced at the printing in the corner and exclaimed: "I say, that Booker Washington is a wonderful man, isn't he? I never saw him, but he's teaching those people there to work." Then he went on to tell me about a young colored man whom he had known who had gone to Tuskegee and learned harness-making, and then come home to set up business for himself. This man told me later that he had never been farther north than Louisville.

It seemed to me as if here was an interesting coincidence of unsought testimony, and all tending to show how consistently Tuskegee teaches a gospel of work. Industrial training goes hand in hand there, with mental and moral teaching, in earnest effort to help the thousand young negro men and women there and make their lives count for the most possible for themselves and their race.

Any one who has heard Mr. Washington speak at any length to audiences of his own race knows how earnestly he advocates industrial education for the negro. As might be expected, then, we find at Tuskegee practical hand training. The advantage is twofold. The students not only learn to work, but in doing so many are en-

An Institute Cabbage Field.

abled to work out all or a part of the expenses which otherwise in many cases would have prevented them from remaining at the school.

Of the thirty-eight buildings at Tuskegee, all but the first three, and these are among the smallest ones, have been built by the students. Several of the largest of these buildings are of brick, and the educational process begins in the institute's own brickyard, where a class of muscular young men are making bricks under the direction of a capable instructor, and in making them learn the trade which they expect to follow in after life. This yard not only makes all the bricks the institute uses, but many thousand more to be sold each year for use in the surrounding country.

I heard Mr. Washington tell to an audience of fifteen hundred negroes, in Charleston, South Carolina, a characteristic story of the beginning of this brickyard. "After I had been teaching a while at Tuskegee," he said, "I began to feel that I was partly throwing away my time teaching the students only books, without getting hold of them in their home life and without teaching them how to care for their bodies and how to work. I looked about for some land, and found a farm near Tuskegee which could be bought. I had no money, but a good friend had confidence enough in our prospects to loan me five hundred dollars to pay down toward the land so as to secure it. After that it was not long before I had the school moved. Then I would teach the boys for a part of the day, and then for the rest of the time take them out of doors with me to help clear up the land. In that way we did all the work we possibly could. When it came to making bricks for a building, though, we were stuck. We could make the bricks, and did, but none of us knew how to burn them. For that it was necessary to have a skilled man, who must be paid. I was out of money by that time, but I owned a gold watch. This I took to a pawnshop and raised all I could on it. The money I got was enough to pay a man to burn the bricks and teach us so that we could do the next ones ourselves. That watch is in pawn yet, but we have got thirty-eight buildings."

Another class of young men are learning bricklaying. They take the bricks as they come from the yard and put up the walls of

"Plain-Sewing" Room.

the buildings, while the carpenters do the woodwork. The classes in woodworking are among the most important at the school. The institute now owns a large tract of valuable timber land, while among the industrial buildings on the grounds is a good sawmill.

equipped with the necessary machinery. Whatever lumber is needed in the erection of the buildings is cut on the timber lot, drawn to the mill, and sawed. In this way one class learns to saw and handle lumber. Besides the regular carpentry classes, joiner work and carriage-making are carried on. A large part of the furniture in the buildings, including the beds, tables, and chairs in the dormitories and dining rooms, was built in this way. All the carts, wagons, and carriages which are used about the place were built in the carriage shop, and the hickory lumber wagons turned out there have so good a reputation that all not needed on the place are sold readily to be used on the near-by farms. The carriages are painted, ironed, and trimmed by the young men, and no better proof of the workmanship can be asked than some of the rides I have had in them about Tuskegee.

"Building a Hat"; Millinery Department.

The management at Tuskegee tries to have a building always in course of construction for the benefit of the building classes. This year they are erecting a trades-school building. Last year they built a handsome brick church, which will seat two thousand persons. The building of this church shows well what the school's building classes can do. The designs were drawn by Mr. R. R. Taylor, the young colored man who is the instructor in mechanical and architectural drawing. One of his pupils designed the cornices with which the building is finished, and another designed the pews which furnish it. These pews were built in the school's joiner shop. The bricks were all made in the school's brickyard, and laid by the students. Men learning slating and tinsmithing covered the roof, and the steam-heating and electrical apparatus were also put in by the students, although this is one of the first of the buildings where the students have been sufficiently advanced in those trades to do the last-named work.

As it was determined to employ only negroes as instructors at Tuskegee, it was at first difficult to find enough men and women of that race skilled in the arts and trades which it was wished to have taught there, and teachers were brought to the institute from all over the country. Now, however, as each year sees the industrial classes better under way, the tide is setting out, and Tuskegee yearly turns out teachers of trades, both men and women, who are eagerly sought by other institutions which are coming to see the value of industrial training. In many cases these teachers go to such positions at lower wages than they might hope to earn if they went to work at their trades, but they do this because they feel they have a duty to the institute and to the friends who have sustained it, to help extend its influence as widely as lies within their power. The question is often asked if a negro having learned a trade can find work at it. I do not think that the Tuskegee students who have thoroughly fitted themselves feel any anxiety about this. I remember speaking on this subject to the teacher in the harness-making and saddlery department, a good workman and a superb physical specimen of a man. He told me that during the long summer vacations he had left Tuskegee, and had never had any trouble in getting work and keeping it in shops in Montgomery and other towns of the State.

Among the buildings at Tuskegee is a foundry and machine shop, which is always full of work, especially in the way of repairs upon agricultural machinery for the farmers about Tuskegee, be-

A Class of Tailors.

cause there is no other shop of the kind within thirty miles at least which has facilities for doing such heavy work as this. Printing, tailoring, blacksmithing, and painting are taught. Since a large proportion of the students at Tuskegee are young women, arrangements are made to furnish opportunities for them also to learn to work. They do all the work of taking care of the dormitories and dining rooms, learn plain and fancy cooking, candy-making, millinery, dressmaking, and all the most modern methods of laundry work. One class learns nursing, under the direction of a capable trained nurse.

In speaking of the trades taught at Tuskegee, it should be remembered that agriculture is reckoned among them, and one of

The Start from the Barn. "Farm Students."

the most important. A very large percentage of the negroes of the South must continue to live upon the plantations and gain a living by tilling the soil. As a general thing their knowledge of how to best do this is lamentably deficient, and they labor under great disadvantages. They do not own their land, but rent it at ruinous rates. They mortgage their crops and eat them up before they are harvested. They plant nothing but cotton, because that is about the only crop that can be mortgaged, and are therefore obliged to buy food at any exorbitant prices which the dealers may demand. Tuskegee tries to remedy these evils by teaching the young men who come there the best methods of modern farming. If the farmers' sons can remain only a short time they carry back to the home plantations some new ideas to put in practice there; if they can remain for the full term of three or four years, they are fitted to take full charge of the work on any large plantation. The institute has a farm on which are raised the crops best adapted to the soil and climate of that part of the South. The men who have charge of this work are among the most able in the entire force of instructors. Mr. C. W. Green, the farm superintendent, has no superior in the South as a practical farmer. Mr. George W. Carver, the head of the agricultural department, is a graduate of the Iowa State College. To my mind, no more valuable textbook for Southern scholars could be furnished than a little pamphlet which this man has recently issued, telling how he raised between two hundred and three hundred bushels of sweet potatoes from an acre of ground, whereas the average yield of that crop in the same part of the country is less than fifty bushels to the acre.

Tuskegee has a large herd of cows and a good dairy and creamery, in which a class of men receive instruction in dairy work. An incident which occurred in connection with this dairy furnishes a story which Mr. Washington likes to tell, because it illustrates a point which he constantly impresses upon his colored audiences. One of the surest ways to abolish the color line, he tells his hearers, is to learn to do some kind of work so well that your services will be really needed.

"There came to my knowledge," says Mr. Washington, "the fact that the owners of a certain creamery were in search of an able superintendent. We had just graduated a man who was thoroughly capable in every way, but he was just about as black as it is possible for a man to be. Nevertheless, I sent him on to apply for

ONE END OF THE DINING HALL AT TUSKEGEE.

the place. When he made his errand known to the owners they looked at him and said:

"'A colored man? Oh, that would never do, you know.'

"The applicant for work said very politely that he had not come there to talk about his color, but about the making of butter. Still, they said he would not do.

"Finally, however, something the man said attracted the attention of the owners of the creamery, and they told him he might stay two weeks on trial, although they still assured him that there was no possibility whatever of their hiring a colored man. He went to work, and when the report for the first week's shipment of butter came back—would you believe it?—that butter had sold for two cents a pound more than any butter ever before made at that creamery! The owners of the establishment said to each other, 'Why, now, this is very singular!' and waited for the second week. When the returns for that week came back—a cent a pound more than for the week previous, three cents a pound more than the creamery's best record before our man had taken charge of it—they didn't say anything. They just pocketed the extra dividend, as welcome as it was unexpected, and hired the man for a term of years. That extra three cents a pound on the price of the butter he could make had knocked every bit of black out of the color of his skin so far as they were concerned."

A Class in Mental Philosophy.

Out of the desire of Mr. Washington to help the struggling negro farmers has grown one of Tuskegee's greatest institutions—the annual Negro Conference which assembles there each year. About ten years ago Mr. Washington invited a few of the negro farmers who lived near Tuskegee to meet at the institute on a stated day "to talk over things." Perhaps twenty men accepted the invitation. These men, gathered in one of the smaller rooms of the institute, under Mr. Washington's leadership discussed the problems with which they had to contend, and different ones among them told how they had succeeded or failed. The meeting was felt to be so helpful that another was planned for the next year. From that small beginning has developed a conference which now brings to Tuskegee, in February of each year, two thousand persons, from a dozen States, and representing many occupations besides that of farming. These men and women are the parents of the generation which is at school at Tuskegee and similar institutions. These fathers and mothers lived " too soon " to be able to profit by such advantages. Few of them can read or write, and nearly all of them know by experience what slavery was. They see their children learning so much which was unattainable for them that they ask, " Is there no chance for us? " The conference is Tuskegee's attempt to answer that cry. As one grizzled old negro preacher, whom I heard make the opening prayer one year, said, " O Lawd,

Delegates to the Tuskegee Negro Conference.

we wants ter tank de for dis, our one day ob schoolin' in de whole year."

Beginning with this year the conferences will be held in the new church, which will comfortably seat all the delegates. Until this church was completed, though, there was no audience room at the institute which would begin to accommodate all who came, and the sessions were held in a rude temporary building, which was also utilized for chapel and graduation exercises. Convenient as the new church is in every way, I shall always miss the unique gathering in that old pavilion. Imagine a broad, low building of unplaned boards, its floor the earth, and its seats backless benches made by spiking planks on to posts driven into the ground. From its rafters hang masses of Spanish moss, amid which streamers of red, white, and blue bunting are woven. On the walls are many American flags, looped back with the spiked leaves of the palmetto tree. Booker Washington stands on a low platform at one end of the room, and all around him, packed just as closely as they can be, are the people, while hundreds of late comers cluster around the doors and open windows like bees around the opening of a hive. No matter if the benches are backless and hard. No opera audience in five-dollar chairs ever sat half so interested for an hour as do these men and women through all the day, which, long as it is, proves far too short for what they have to say. This is the one day of the year for them, and not a minute must be wasted. The speakers are the men and women themselves. Mr. Washington simply starts the discussions and steers them so as to make all the time count. He is a genius as a presiding officer, and gets more out of the limited time than any one else could do. The subjects which they discuss are the practical ones which concern them most vitally. Some I have mentioned—non-ownership of land, crop-mortgaging, and the evil of raising only cotton. Others are the need of a longer school year and how to get it, the foolish extravagances of buying showy clocks, sewing machines, and organs before a house is owned to put them in, and similar subjects. The time is never long enough for all there is to be said. The effort is to make this a center from which some helpful thought will be carried out to take root during the year.

I saw a striking example of the influence which the conference may exert at one of the sessions. A tall young mulatto woman had finally succeeded in getting a chance to speak, for there are always twice as many to talk as can find time. "Last year brother Washington told us," said she, "that three acres of land, properly carried on, would support a person, and told us how, and said that a woman as well as a man could carry on the land. I made up my mind I'd try it. I did, and it's so. I hired three acres of land and had it plowed. I had it plowed deep, too. No lazy nigger half done the job, for I sat on the ground myself to see it done." She then went on to tell what her seed and fertilizer had cost, what she planted and raised, and what her profits were, showing them to be quite enough, as she had said, to support her for a year.

Loud applause greeted this report, and cries of "Dat's good!" and "Go ahead, sister!" but through it all the woman was seen to be still standing where she had spoken, waiting for a chance to go on, and with no sign of satisfaction in her face at the approval shown her. Raising one yellow hand high above her head, as soon as she could be heard, she cried in a strangely thrilling voice, which echoed through the dusky room: "How can you waste the one day of the year for us in such foolishness, when the life of a race is in jeopardy? Get to work! We must learn first to help ourselves, if we want God to help us!"

NEGRO CONFERENCE IN SESSION IN TUSKEGEE INSTITUTE CHURCH.

Hardly had this woman finished speaking when it was seen that another woman had risen and was waiting for a chance to make herself heard. I think I never saw a more pitiful figure. Very black, old, with a gaunt form on which a shabby dress hung loosely, her face was that of a person for whom life had been so hard that hope was for her a word unknown. Two or three men in the audience said, "Oh, sit down!" as if they wondered what such a person could have to say which would not be a waste of the meeting's time, but she would not sit down. Standing there until the noise had hushed, she began:

"I wants ter tank Gawd I'se come here ter day an' heard what dat sister had ter say. I don' know what made me come. I'se nebber been here before, but I'se so glad I come ter-day! I'se been de mother ob sixteen chillen. I hain't nebber had a home nor a mule nor eben a dress dat wa'n't morgiged. My chillen's gone an' lef' me as soon as dey's growed up, an' now my ole man is gone too. I tought dere wasn't nuffin lef' for me ter do but jes' die, but now I'se goin' home an' get some lan' an' do for myself an' my littles' chillens what nobody has ebber done for me. I kin do it, an' I tank Gawd I'se been here ter git de word."

It seems to me as if this was missionary work of the best kind, and it is such work as this that Tuskegee is doing constantly.

RECENT LEGISLATION AGAINST THE DRINK EVIL.

By APPLETON MORGAN.

[*Concluded.*]

X. Quality Inspection.—In my paper in these pages, in 1894, I remarked, "If there is any such thing as a salutary liquor law, not derived from excise or police jurisdiction, it would be, perhaps, a statute insuring the purity of liquor; reviving that old English functionary, the 'ale-taster,' with his care over all drinkables exposed for sale." And surely this would be a legitimate and a constitutional law, as providing for the public safety (which is, after all is said, the origin and summit of all law). To kill a rattlesnake the rattlesnake must first be recognized as alive, and the old cry of the Podsnap that nothing improper exists is fast disappearing. It seems to me that at present, and in view of the fact that Mr. Reed's plan would involve a social and economical plant which could only be accumulated by long and deliberate legislative action, and admitting that the drink evil not only calls for legislative action but has received it for sixty-two years, and so accustomed our communities to expect it; admitting also Mr. Bellamy's and Mr. Reed's basic proposition that there is no reason why any human being should starve, and that it is not public policy that any creature of the State (even if a criminal confined for crime in a State penitentiary) should starve—admitting all these, it seems as if this plan really might be the best and most immediately practicable plan yet. Every State, without any criticism or clamor of constitutionalists against paternal government, appoints its official tester of illuminating fluids, that conflagration may not ensue and the public safety be imperiled by the destruction of the citizens' homes. Why not a State "tester" of the stimulant which may inflame the vital forces of the citizen himself, and so imperil the public peace, which, by all laws, is the public safety? Municipal corporations appoint inspectors of meat, of milk, of fruits, of confectionery, precisely under this constitutional duty of preserving the public health, upon which, most largely of all, the public safety depends. Why not, then, inspectors of the potables which the public drink?

By having liquors examined, and only pure liquors sold, and condemned liquors destroyed, precisely as in the case of unclean or impure meats, milk, fruit, and confectionery; much could be practicably, and in a minimum lapse of time, accomplished to the decrease of the liquor evil. The prohibitionists themselves, by placing and replacing and abolishing and experimenting with all sorts of statutes upon the statute-book, have accustomed us to State regulation of the sale of intoxicants, and, least of all, can complain of yet one more experiment toward the decrease of drunkenness.

Let the national or State government have liquors examined, and those not up to the standard emptied into the sewers, precisely as in the case of milk found filthy, dangerous, or questionable. The Government might also supervise the distilleries and forbid the manufacture of what are called "quick-aging" goods, or "continuous distillation," precisely as it controls the manufacture of oleomargarine. It is not improbable that a commission appointed to this good work might, by just, equitable, and easily-to-be-borne statutes, prescribe a time limit or period after which no spirituous liquors should be sold less than, say, five years old (the age of liquor being said to regulate its irritant and insanitary and to conserve its really salutary and sanitary qualities). I believe (not without consultation and a deliberate exchange of opinion with experts) that the good effects of such legislation would be almost instant; I believe that from pure motives of self-interest alone the distillers and rectifiers of liquors, instead of fighting such a law, would be eager to compete to furnish pure brands of liquor for the State censors, in the certainty that the State must adopt the best and the purest. To-day the public is served with precisely what the publican finds it most to his profit to sell. It may be only dirty water which he sells at a price at which he could (to his own immense profit) sell pure liquor. In every drinking place in the land, to which the public resorts, there are two prices—one price for what you order, and the other for the same "good." I believe that one of these days the world will remember, as curiously as it now remembers the days of the stagecoach or the tallow-dip, a time when a man desiring a dram of liquor was obliged to drink whatever the dram-seller found it profitable to sell him.

We have tried about everything else. Why not try this? We have conceded to our legislators the right and the jurisdiction. Since we can not adopt Mr. Reed's proposition to feed everybody, why not enter the wedge right here and do the next best or a next best thing—see that the people not only eat proper meats and fruits, but that they drink, if drink they will, pure liquors? And it need be added (however it may appear to be a sop to Cerberus) that it would not antagonize that most powerful class, whose organized and capitalized opposition every other liquor-regulating law which has ever been suggested has at once antagonized, and been obliged in the end to if not conciliate, at least to recognize in the adjustment of equities. Fortunately, we have not to begin our experiments out of whole cloth. Illinois, Michigan, Ohio, Massachusetts, New York, and Washington have led the way, and made the adulteration of liquor a misdemeanor. (New York, however, has probably negatived the best results of the prohibition by adding that the prohibited adulteration must only be "with any deleterious drug, substance, or liquor which is poisonous or injurious to the health," which is shutting one door and opening another, and relegating to the lawyers and their experts a tedious inquisition as to what the word "poisonous" or the term "injurious to health" may mean, in the course of which the offender would walk free.) The question as to whether it would conserve the public peace as well as the public safety by decreasing drunkenness can only be favorably conjectured. Experience of such a law only can show. To begin with, it would increase the cost of a dram. A glass of true whisky, for example, might be twenty cents instead of ten, and (the law forbidding adulteration) this would probably in itself lessen dram-drinking. In England, many years ago, a similar law was found to eventuate in compelling that only the highest grades of ale should be sold at a certain price. This led to the offering of a second, and then of a third grade, and finally of what was claimed to be a blending of all three grades or an "entire" (which was the origin of the term ENTIRE, that later began to be the name of an alehouse—a legend still seen on English alehouse signs). But the law we now suggest, by preventing the blending of three grades of spirits, might, while lessening the sales, increase the excise revenues, and perhaps accomplish whatever may be left to be accomplished in conserving at once the health, the peace, and the income of the State.

That a system by which only pure liquors can be exposed for sale as beverages is feasible, seems already assured, the States of

Ohio, Illinois, Michigan, Massachusetts, and Washington having already long since adopted a partial statutory policy of the sort, and the State of New York, in 1896, having followed. In order to demonstrate what these have accomplished, and what improvements can be suggested, there were addressed to the proper officers of each of these States the following questions, viz.:

1. In your State what officer is charged with enforcement of the provisions of its liquor statutes, forbidding adulteration of liquors exposed for sale as beverages? And must such officer be examined as to his experience or as to his competency only?

2. Is his standard of unadulterated liquors established by law, and if so, what is it? Or is the officer's judgment as to what liquor may or may not be sold discretionary according to the circumstances of each case?

3. Is the examination to be conducted by taste or tasting (sampling), the old English method, or by chemical analysis?

4. Is adulteration so defined as to include the mixing of liquor with water, or only with substances or liquids in themselves toxicants?

5. Is the effect of this clause thought to be beneficial? Has it, for example, decreased drunkenness?

To the first question Mr. Samuel P. Sharpless, State Assayer of Massachusetts, reports as follows: "An assayer of liquor is appointed under our public statutes, who is charged with performing such duties as are referred to him. No particular examination prior to appointment is laid down. The presumption is that an analytical chemist will receive the appointment, as in the twenty years in which the law has existed only analytical chemists have received the same."

As to Ohio, Mr. Joseph E. Blackburn, Dairy and Food Commissioner, says: "The office of Dairy and Food Commissioner is charged with the enforcement of all laws governing the sale of food, drink, and drugs. He is not required to stand any examination, and his experience and qualifications are not considered except as to his eligibility as a candidate. It is distinctly a political position, and all the parties nominate candidates for the place."

As to Michigan, Mr. Elliot O. Grosvenor, Dairy and Food Commissioner, says, "The Dairy and Food Commissioner of the State is charged with enforcement of the law relating to adulteration of liquors."

As to Illinois, Hon. E. C. Akin, Attorney-General, writes: "It is the duty of the several State's attorneys to prosecute for violations of this section, on complaint of any one, or by indictment. There is no officer charged with the duty of making examinations or tests of liquors."

As to New York, Hon. Henry H. Lyman, Commissioner of Excise, replies: "The district attorneys of the several counties in this State have direct and exclusive control of all criminal prosecutions against violators of the liquor-tax law, but indirectly the matter of enforcing this section devolves upon the State Board of Health. By the provisions of section 42, chapter 661, laws of 1893, the State Board of Health shall take cognizance of the interests of the public health as affected by the sale or use of foods and adulterations thereof, and make all necessary inquiries and investigations relating thereto. It shall appoint such public analysts, chemists, and inspectors as it may deem necessary for that purpose, etc. Upon discovering any violations of the provisions of the act relating to the adulteration of foods or drugs, the State Board of Health shall immediately communicate the facts to the district attorney of the county where the violation occurred, who shall thereupon forthwith commence proceedings for the indictment of the persons charged with such violations."

To the second question, as to what is held to be adulteration, in Massachusetts the only standard fixed by law is that of the United States Pharmacopœia. Chapter 272, Acts of 1896, undertakes to provide certain standards. But so far not a single case has been brought under this act, since it has not been made the duty of any one in particular to enforce it. The assayer and inspector can only examine such liquors as are brought to him by the proper officers. He has no authority to institute proceedings even if he finds the liquor to be badly adulterated. Such action must be taken by the officers making the seizure. But Mr. Sharpless writes that, in his opinion, the law (section 31 of chapter 100 of the public statutes) providing for taking samples of liquors for analysis contains in its last sentence a clause which renders it inoperative: it requires such samples to be paid for if they are found to be of good quality. Mr. Sharpless adds: "Under this section I have received perhaps on an average twenty samples a year for the past fifteen years. These samples have generally been whisky, gin, brandy, and rum. The Legislature has been repeatedly requested to give the assayer authority to take samples in the same manner as they are taken by the milk inspector, but has as uniformly refused to give him that power."

Ohio reports that the legal standard for liquors is the requirements of the United States Pharmacopœia.

In Michigan the law does not define any standard for adulteration or unadulteration. Nor is it left to the mere judgment of any officer. "In case of prosecution the fact of adulteration would have to be proved to the satisfaction of the jury by any competent evidence." This is the language of Mr. Samuel A. Kennedy, Deputy Secretary of State. Mr. Elliot O. Grosvenor, the Dairy and Food Commissioner, indicates the nature of the evidence, however, as follows: "If the word 'standard' can be used in connection with the word 'adulteration,' our law does regulate this standard. We send you under another cover a copy of the law concerning liquors, so far as within the jurisdiction of this department, from which you will see we have little or no discretion in the matter." The clause marked by Mr. Grosvenor is as follows: "The law relating to liquors seems to be meant only to prohibit the sale of spirituous or fermented or malt liquors containing drugs or poisons or substances or ingredients deleterious or unhealthful; and provides that each barrel, cask, keg, bottle, or other vessel containing the same shall be branded or labeled with the words 'Pure and without drugs or poison,' together with the name of the person or firm preparing the package. This applies to every package of whatever size—it matters not whether they are put up for immediate delivery or for stock purpose. This includes all bottled ale, beer, rum, wine, or other malt or spirituous liquors, also the bottles used for dispensing over the bar. The State has no standard of proof, but liquors in packages where proof is indicated must test to that proof. Compounds containing nothing deleterious or unhealthful may be sold as cordials. The blending of liquors will be permitted, if spirits or other ingredients are not added. Dealers purchasing and receiving goods not properly branded or labeled are not relieved from any responsibility, if they sell the same without branding or labeling."

In Illinois the standard is not mentioned, but the articles forbidden are plainly set forth by the criminal code of the State, which provides that "whoever adulterates, for the purpose of sale, any liquor used for drink, with cocculus indicus, vitriol, grains of paradise, opium, alum, capsicum, copperas, laurel water, logwood, Brazilwood, cochineal, sugar of lead, or any other substance which is poisonous or injurious to health; and whoever sells or offers, or keeps for sale any such liquor so adulterated, shall be confined in the county jail not exceeding one year, or fined not exceeding one thousand dollars, or both."

In New York there is a standard fixed for wines, and sections 46, 47, and 48 of the laws of 1893 are devoted to the definition of pure wine, half wine, made wine, and the adulteration of wines generally. But there is no standard of purity enacted for spirituous or malt liquors, and it is left to the discretion of the inspecting officers whether any liquors inspected and analyzed by them contain any deleterious substances.

As to question third, all the States seem to agree that chemical analysis is the safer, but adulteration seems to be considered by them all as a fact, to be proved by any competent process, even the taster not being barred, as he certainly is not by the clause as to inspection in the State of New York. Mr. Grosvenor, Food Commissioner of Michigan, however, says that the only test recognized by his department would be that made in its own laboratory by its own two chemists.

As to whether the adulteration could be by water only, all our courteous informants refer us to their answer to the question as to standards but Ohio, whose Food Commissioner (Blackburn) replies, "Yes, if the proofage is reduced to less than one hundred degrees." In Massachusetts, Mr. Sharpless says, "In a case brought a number of years ago the court refused to consider water as an adulteration; no recent case has been brought."

As to the fifth and vital question, whether the clause against adulteration tends to decrease drunkenness, Mr. Sharpless adds the following valuable record of his experiences as State assayer in a State which, in thirty years, has experimented with about every known form of liquor statute: "So far as I have observed, the quality of the liquor has but little to do with the question of drunkenness. In some localities where prohibition has been strictly enforced we find that the class who will have liquor is obtaining it in other than the well-known commercial forms. Frequently we find that large quantities of extract of ginger are being consumed. A number of cases have been brought against the venders of this article, as an alcoholic beverage containing more than one per cent of alcohol. These cases have generally proved successful in stopping its sale. Essence of peppermint and of checkerberry, for example, are favorite tipples. During the past summer a case was found in which 'So-and-so's Drops,' a nostrum, a mixture of ether and alcohol, was being used as an intoxicant. The so-called 'native wines' have given us some trouble. These are essentially a fermented solution of sugar and water, with sufficient juice of some fruit for flavoring and color. When made without the addition of spirits they contain about fourteen per cent of alcohol. They are generally pretty poor stuff. About two years ago we had an epidemic of so-called 'malt extracts.' These, with very few exceptions, were found to be essentially porter. The alcohol in them averaged about six per cent, and they were quite palatable beverages. They contained about seven or eight per cent of solid extract.

"It has been several times proposed here that no liquors should be sold unless their purity was certified to by the State assayer. This I have uniformly opposed, for the reason that, while the State may well prohibit the sale of adulterated liquors, it is no part of its business to certify to the purity of any man's goods; and, unless the State becomes the sole vender of liquors, it has no means of keeping track of them.

"It has been my practice during my term of office never to give a certificate in regard to a liquor to any one but the officers authorized to ask such a certificate. In other words, the only way a private person can get an analysis of liquor made by the State assayer is to take it to the chief of police of his town or city and make a complaint in regard to it; as the assayer is paid by the State for his work, it would obviously be wrong for him to do work which he might have to revise in his official capacity. . . . I may perhaps be allowed to add a few words as to what is defined in this State as an intoxicating liquor. When the State assayer of liquors was first appointed he soon became convinced that some limit must be fixed to the allowable amount of alcohol contained in a liquor. After consultation this amount was fixed at three per cent by volume at 60° F. This law remained in force several years. Soon after it was found that a large amount of beer was being made which contained about 3.5 per cent of alcohol. This was a palatable beer, and the venders gave the officers much trouble. The regular trade, who were selling lager beer and ale, and paying for the privilege, were also much opposed to its sale, and the Legislature was asked to reduce the limit to one per cent by volume. This at one stroke destroyed a large amount of illegitimate trade. The Massachusetts law, as it now stands, is that ale, porter, strong beer, lager beer, cider, all wines, and any beverage containing more than one per cent of alcohol, by volume, at 60° F., as well as distilled spirits, shall be deemed to be intoxicating liquor, within the meaning of the license provisions, and this section of the law has been decided by the Supreme Court of the Commonwealth to be constitutional.* The question is never raised now in the court as to whether a liquor is actually intoxicating; the only question being, Does it contain more than one per cent of alcohol? If it does (and as a matter of fact cases are very rarely brought in which the sample does not contain at least two per cent of alcohol), the court has no power except to convict, if it be proved that the article was kept for sale. The result of this law has been that the sale of beer, with the idea that it is possible to convince the court that it is not intoxicating, has entirely stopped. Some few attempts are made to produce a beverage that shall contain less than one per cent of alcohol. And several brands are on the market which, when cold, taste very well, but which contain only about 0.85 per cent of alcohol. Generally the only test made in regard to liquors is as to the amount of alcohol that they contain; or, rather, whether the amount of alcohol exceeds one per cent, that being the maximum amount that can be sold without

* *Vide* Commonwealth *vs.* Brelsford, 161 Mass., 61.

a license. Such examination is generally made by distilling the liquor and determining the alcohol in the distillate.

"The whiskies examined have in Massachusetts, as a rule, been free from any substance more injurious than the alcohol they contain. They have generally (as well as the other distilled liquors examined) been of standard strength—that is, they have contained about fifty per cent of alcohol, and as a rule have not given much over the amount of residue allowed by the Pharmacopœia. As you will see by the foregoing remarks, the provisions of the Massachusetts liquor law, so far as adulteration is concerned, are practically a dead letter. I have been repeatedly before the Legislature asking for such modifications of the law as would enable me to make an intelligent study of the subject; but it seems satisfied to allow the matter to stand as it now is. Several difficulties arise in regard to any enforcement of the law. One of these—that samples must be paid for, and there is no appropriation to pay for them—I have already pointed out. In the second place, the State Board of Health (which has full power to inspect liquors under the food act) has discovered that the chief adulteration is water in distilled liquors, and that this, together with a little burned sugar and sirup, is practically the only adulteration. Large amounts of rectified spirits are used in the preparation of whiskies for the market, where the whisky is used only as a flavoring material. But such manufactured whiskies meet the requirements of the Pharmacopœia better than the genuine article, being more free from the higher alcohols and ethers than a pure whisky. The only point in which they do not agree is that they are not three years old. But the only method for determining the age of a liquor that I am acquainted with, is the brand on the barrel. It certainly can not be determined by any chemical means."

But, with the exception of Massachusetts, where Mr. Sharpless points out clearly the reason why the law against adulteration is a dead letter, all the reports speak encouragingly. Michigan, Illinois, and Ohio believe that the operation of the provision will do genuine good. Says Food Commissioner Blackburn, of Michigan, "It is my opinion that this law has and will decrease drunkenness, for the reason that pure liquor will not create the unnatural appetite that compounded, adulterated, or artificially prepared liquors do."

The State of Washington sends no report. There is a provision in the South Carolina law providing that liquors shall be "pure"; but, as the State is the dispenser of liquors, the operation of this clause has not been considered exemplary for the purposes of this article. Mr. Lyman, in New York, thinks that sufficient time has not elapsed to fully pronounce as to the benefits of the law.

XI and XII. High License and Local Option.—Certainly the examination of these statutes and reports of their results in forty-nine States and Territories leaves it beyond question that so far the very best results have accompanied the combination of these two provisions. Perhaps the best example is in the largest of the communities to be affected—viz., in the State and city of New York. Here, by separating the plebiscitum or referendum into four local options—viz., (1) selling liquor to be drunk upon the premises where sold, (2) selling liquor not to be drunk upon the premises where sold, (3) selling liquor by apothecaries only on physician's prescription, (4) selling liquor by license granted to "hotel keepers" only—the result obtained has been, I think, precisely what I contended for in the paper of five years ago, namely, the value of liquor has been recognized, and its sale provided for without denying its dangers as a temptation, or the disastrous effects of drunkenness. To use the exact words of the commissioner's report: "The tendency is to recognize the propriety of the sale of liquors by hotels and pharmacists in many communities where they will not, by their votes, approve the sale by saloons and groceries; and while there are now twenty less absolutely 'no-license' towns than when the law took effect, there are very many less saloons and groceries where liquors are dispensed." And this while not in any way compromising or dallying with the proposition which the prohibitionists and temperance societies insist upon (and which is all they have as a basis for their claims), viz., the consequences of intoxication and the public policy of its prevention. To show that, as a fact, an equivalent result has been reached in every State in the Union where high license and local option are united, would unduly tax these pages. But one or two prominent examples are of the paradoxical results—as gratifying as they are paradoxical—that the fewer the places where liquor is sold the larger the revenue to the State, and the less the drunkenness, may be cited. In the State of New York in two years of high license the reduction in selling places was 5,484; the increase of revenue to the State was $9,094,646.01; the decrease in the number of arrests was 22,689. In the city of New York alone the reduction in places was 1,204; the increase of revenue was $3,549,851.90; the decrease in the arrests for drunkenness was 3,044. Similar results are reported invariably as the fruit of high license elsewhere in the United States. In the city of Chicago, under an exceedingly high license, the reduction in one year was 200 in the number of saloons, while the increase of revenue was $1,250,000; and yet the decrease in the number of arrests was 1,217. Contrast this result with the condition of affairs in the triple-steel-barred prohibition State of Maine! Says an ex-Mayor of Portland: "I went into office perfectly free; I think I enforced the law impartially with all the vigor I could control. . . . I looked it all over to see what I had accomplished; I found that I had driven out of the business one set of men, and another had come in worse than the first. I found that the young men were establishing club rooms. Not only did they become drinking places, but they brought in gambling and other vice. While I was driving liquor out of the ordinary shops I was driving it into houses and kitchens, where even children dealt in it. . . . I am sorry to say it, but the law makes perjury alarmingly common; it opens up . . . an avenue for bribes.*

"The local authorities could not be trusted to enforce the law. The price of liquors has been lessened and the quality is worse. . . . To those who shunned the open bars the apothecary shops supplied liquor by the bottle as often as desired. . . . Then arose pocket peddlers, young men who loiter about the street supplying customers from the bottle with a drink known as splits—a concoction of the cheapest alcohol mixed with a dash of rum and coloring matter, which produces a dangerous form of intoxication. . . . At the city agency the question 'Medicine?' and the answer 'Yes,' was quite sufficient, and throngs of people were constantly waiting with flasks to be filled. . . . 'Bars,' 'Eating Houses' (so called because protected by the police), 'Kitchen Bars,' 'Pocket Peddlers,' 'Hotel Bars,' 'Apothecary Shops,' 'Bottling Houses,' 'Express Companies,' 'Clubs,' and the 'City Agency.'"

But all these, under the very eye of the late Hon. Neal Dow, were powerless to convince the Hon. Neal Dow that his policy was not a massive and monumental success, and to the end of his days the good old man delivered glowing eulogiums upon its exalted benefits to a suffering and liquor-ridden world!

Among the novel devices among the statutes of States classed as licensing sales of liquor (or which have rejected prohibition) may be mentioned the following: Apothecaries may sell without a license if they keep records of sales. Purchasers of liquor must make affidavit of the purpose for which they require the liquor. Physicians prescribing liquors must make affidavit that they are required by the case they are attending. Public officers who tolerate or refuse to prosecute are fined. Name of owner of premises where liquors are sold must be painted in large letters on outside window with the word "owner" added. A provision that any one may sell liquor, but that the Legislature may provide in any way it sees fit against "the evils resulting therefrom." No barmaids, or dancing, gambling, or oil paintings on premises where liquor is sold. The pro-

* Annual Report of the New York State Commissioner of Excise, 1897–1898, p. 716, Id.

visions that eatables must or must not be sold where liquor is retailed are about numerically even. (It will be remembered that the New York ["Raines"] law at first abolished free lunches, but insisted that while one must not have food with his liquor on week days, he could not on Sundays have it without—the last provision still being enforced). Similarly, in some States, liquor dealers must not keep lodging houses, while in others they must. West Virginia says that a tavern or hotel must not be used as a liquor-selling establishment only, and that a refusal to give diet or lodging to any one demanding it will forfeit its license to sell liquor. One State (Colorado) recognizes the so-called "gold-cure," and authorizes "the person most interested," or the county, to send habitual drunkards at county expense to "any respectable gold-cure institute." In Illinois a drunkard is by law a vagrant, and drunkenness is a cause for divorce. In Louisiana the excise man who makes an erroneous estimate of the amount of business done (Louisiana regulates the liquor business according to sales only, disclaiming any preventive or reformatory object) is removable from office. In Tennessee applicants for license must state the amount of business they intend to do. Kentucky regulates the price of liquors sold, being the only American State so doing (except that South Carolina says that the price of a potion shall not be "more than fifty per cent above," or if used as a medicine "more than ten per cent above," the cost thereof to the seller—rather a difficult matter to approximate). Arkansas prohibits sales within three miles of a church, schoolhouse, or academy. The sales of liquor to Indians is prohibited, and the exclusive right of army officers to purchase it is conserved, at the proper frontiers. Texas inserts in her statutes a fine for keeping a "blind tiger" (defined to be a place "where intoxicating liquors are sold by any device whereby the party selling or delivering the same is concealed from the person buying or to whom the same is delivered"). And, in Kansas, twenty- five reputable women must unite with twenty-five reputable men in applying for a license to sell liquor. No State or Territory mentions the size or quantity of liquor to be sold at any price, as is the European custom.

It would seem, therefore, that, with the exception of the State of Maine alone, all the American Commonwealths are gradually harking back to the standpoint of the earliest liquor laws. Moderation (temperance) in drinking was the public policy. Leaving out the act of the British Parliament, in the year 1735 (which gave Governor Oglethorpe the right to prohibit the importation of ardent spirits into Georgia, which was not a measure to prevent intoxication, but to give a monopoly to Governor Oglethorpe), the first temperance association was that founded by Dr. Rush; and it is related that the venerable president, upon being elected, rose with a glass of brandy in his hand and gave the toast: "Gentlemen, fill your glasses. Let us show the world that we know how to drink in moderation."

To sum it all up. Why, since we can not set out with a club or a headsman's axe to reform mankind; since there are substantial rights to adjust and innocent parties to protect, why is not the proposition to prevent by law the exposure of adulterated liquors for sale as beverages the best so far suggested? Is there another which at the same time is constitutional, equitable, peaceable, and so conservative of the public safety, which creates no law-breaking class out of honest citizens, sheds no blood (as blood was shed in South Carolina in 1875 because men of Anglo-Saxon breed could not be readily made to concede that a man's house was not his castle), and which imports no new doctrine into American policy?

I, for one, believe that, with it, the solution of the drink problem would be in sight. High license and personal damage laws are two thirds of it. If a man desires to sell liquor let him pay one or two thousand dollars, or other substantial sum of money, to the school or the police or the poor fund of his neighborhood. Let him be liable in damages, as are common carriers or any others who deal in conveniences or commodities in which there is possible risk to the community, for what is injured by his operations. As to the remaining third of the remedy: the sole objections to local option (viz., that it may be abused at the polls, where the total-abstinence interest might be as capable of a wrong use of money or of other undue influence as the liquor interest, or that it might be inconvenient to the public) are fully met by making adulteration impossible and providing for a compulsory, rigid, and universal inspection of liquors exposed for sale as beverages.

And then, besides, it will be unnecessary to burn down our village to roast our pig.

A CURIOUS experiment, at Carnot, in the Congo, is described in the journal *Le Chasseur Français* in the shape of the collection and raising of the animals which the natives bring in from the bush. Large numbers have been taken in. Some of the animals die, some escape. Among those that have stayed are two wild hogs, which roam at liberty, eat from the hand, and follow like dogs. There are a jackal, mangoustes, small rodents, a company of monkeys, and a young tiger cat, "which is the lawgiver to the others." None of the animals is confined, except that the jackal is tied, though he follows; but it has been necessary to separate the guinea-pigs from the rest. A large monkey has assumed the office of shepherd's dog, and takes care of the sheep. There are also dogs—"good company, but not of much value"—eight horses, with a colt that will eat at the table if allowed to; forty horned cattle, which are multiplying; and asses, which are also increasing.

HAWK LURES.

By W. E. CRAM.

IT is a pretty well known fact among hunters and students of Nature generally that most flesh-eating animals, whether in fur or feathers, can be more readily called by imitating the squeaking of mice than in any other way, and proves conclusively enough that these creatures depend largely on the sense of hearing in their struggle for a livelihood.

My first practical illustration of this fact occurred so long ago that it seems almost like ancient history.

For some reason or other one summer's vacation began some six hours earlier than was expected, and although apparently insignificant enough when compared with the entire three months that were to follow, that extra half holiday was probably valued out of all due proportion by the pupils, owing to its unexpectedness, and for that reason, perhaps, more than any other, is still recalled by one at least as distinctly as ever.

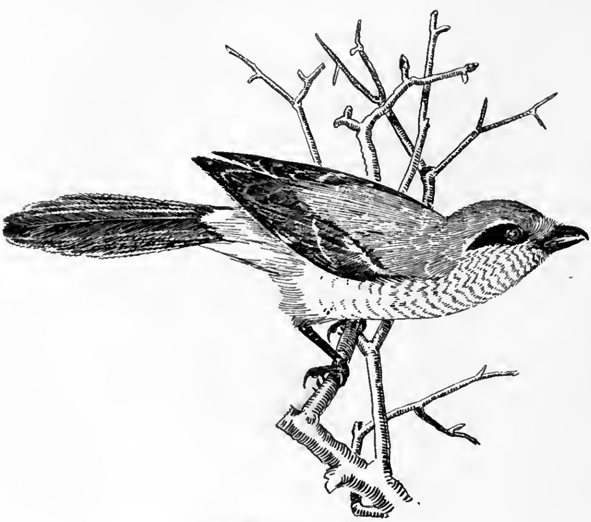
One of the boys had a contrivance known as a bird-call—a simple instrument of wood and some soft metal—that, on being turned, produced noises that bore not the slightest resemblance to the cries of any bird, but were not entirely unlike the squeaking of a mouse in distress.

Mephistopheles.

Some of us were more or less skeptical as to its powers of attracting birds, and decided to put it to the test. So we loafed about under the apple trees working the thing for all it was worth, but no birds came about us, and the bird-call was in danger of being thrown away in disgrace, when a small brown beast appeared from under a pile of boards and came running toward us, till suddenly scenting danger it disappeared. There was some discussion at the time whether it was a rat, chipmunk, or red squirrel; none had seen it very clearly or could give any very definite description of it, but in all probability it was a weasel attracted by what it supposed to be the voice of its accustomed prey.

About halfway between that time and the present a young long-eared owl became an important member of our family, a most original and amusing bird, without the slightest fear of any of us. He was christened Mephistopheles.

As he was learning to fly, it seemed advisable that he should be taught to come at our call to be fed; and accordingly one day, by way of experiment, I held out a piece of meat to him and squeaked like a mouse. There was a rush of downy pinions, and his talons were neatly arranged about my lips. He was evidently a good deal excited, but was careful not to hurt me any more than was absolutely necessary in order to secure the mouse which he fancied he had cornered in my mouth. I was just reckless enough to try it again on the following day as he perched on the low branch of an apple tree. His power of detecting the direction whence the sound came proved fully equal to the occasion, and the result was the same as in the first instance. The end of Mephisto was tragic in the extreme. He was sometimes fastened by a linen cord six or eight feet long and as large as a lead pencil, which when not in use was hung across the perch where he slept. Evidently he felt that the food furnished him was too effeminate, for the powerful stomachs of all birds of prey require a certain amount of such indigestible matter as hair, feathers, or bone to keep them in good condition. So one ill-fated night, in looking about for something that would answer that purpose, he unfortunately hit upon the cord as a substitute, and proceeded to swallow one end of it. The first few feet must have fully satisfied his cravings, but there was the rest to be disposed of, and the most feasible method that presented itself naturally was to go on swallowing. The thing must have grown extremely dry and distasteful as inch after inch disappeared, still there was nothing for it but to go on, which he did. In the morning he was strangely silent and gloomy, with hardly a foot of cord protruding from his beak. Any attempt on our part to remove the cord proved not only fruitless but painful,



NORTHERN SHRIKE.

so it was cut off close to his beak, whereupon he swallowed what remained in his mouth and looked relieved. His meal proved too much for him, however, and he only lived a few days after it.

The different species of hawks vary greatly as regards the readiness with which they may be called—most of them, in fact, absolutely refusing to be lured in any way. As might be expected from its habits, the marsh hawk is the most susceptible, and in still weather may be brought from a distance of one hundred yards or more. At the first squeak he wheels about in the air and comes directly toward you with most unexpected impetuosity and swiftness. His discomposure on discovering the fraud is usually most amusing, as he stops short in mid air, with wings and legs asprawl, and turning his back on you, hurries off in feverish haste.

The red-tailed and red-shouldered hawks are also easily attracted in this manner, but the rough-legged hawks, although they live almost entirely on mice, are not so readily deceived, though this is undoubtedly owing more to their extreme wariness than to any dullness of hearing on their part.

None of the falcons or short-winged hawks pay the slightest attention to the most lifelike squeaking, so that evidently when they do deign to attack such ignoble quarry as a field mouse they depend more on their eyesight than on the sense of hearing. One still October day the red-tailed hawks were soaring and screaming above the pines beneath which I was hidden; by mimicking their cries I enticed one of them nearer and nearer, till at last he closed his wings and alighted bolt upright on a dead stump not fifty feet away. Changing my tactics, I endeavored to convince the hawk that a family quarrel was in progress among the mice in the thick clump of pines below him, and was rewarded by seeing him turn first one keen eye and then the other on my place of concealment; then he leaned forward and crouched catlike on his perch, half opening his broad wings and shifting his feet about in his impatience. But he evidently desired more positive evidence than his ears could give him before making the final dash for his breakfast. There was a slender dead branch beside me, and cautiously taking this, I shoved it slowly along under the carpet of pine needles out into the opening, as one sometimes amuses a kitten with a pencil beneath the tablecloth. The instant the hawk's eye caught the movement of the pine needles he descended with a whir almost to the point of seizing the stick in his claws; then, catching sight for the first time of the author of his disappointment, he rose flapping into the air, shrieking out his anger to the skies. If we had been more evenly matched in weight, I fear I should have suffered the most extreme punishment for my deceit.

The northern shrike is generally given the credit of living to a certain extent on mice, but the only evidence pointing in that direction that I have ever seen is that, like the mouse-eating hawks and owls, he comes quickly enough to the call; nor is there any need of concealment when dealing with this bird. He will come fearlessly within a few yards of you, hopping and flying from twig to twig, with his long tail continually moving up and down in his excitement, apparently impelled more by motives of curiosity than hunger.

But when it comes to calling up to you such shy creatures as the mink or fox the utmost caution is necessary, for although lacking the keenness of eyesight possessed by birds, the acuteness of their sense of smell and hearing is something marvelous; yet when conditions are favorable they may sometimes be brought quite close and studied to advantage.

Standing one day beside an old tumble-down rail fence that ran along between the woods and salt marshes, half hidden in the brambles and tall grass, I caught the merest glimpse of a mink slipping along between the bottom rails. As he was evidently unaware of my presence, I determined to see more of him, and squeaked in as mouselike a manner as possible, and quickly had the satisfaction of seeing him make his appearance on a projecting stake much nearer than when I had first seen him. Stretching himself along the stake, he appeared to listen and look in my direction, but although I was standing in plain sight on the edge of the marsh hardly a rod away, the fact that he was obliged to look directly into the sun made it quite impossible for him to clearly distinguish what he saw. At the end of a few moments he dropped into the grass and started in my direction, the trembling grass blades clearly indicating his progress as he approached nearer and nearer, until almost at my feet he vanished, and, in spite of the most patient waiting on my part, absolutely refused to show himself again.

The last instance of the kind that has come under my notice happened on a clear moonlight night as I was wheeling along a lonely road between old apple orchards. Some part of the machine squeaked at intervals in a way that might possibly have been mistaken for a mouse. At all events, an owl appeared to have been deceived thereby, for he came flapping out of the orchard and flew alongside, at times coming quite close and again swinging off into the shadow, till at last, convinced that his supper lay not in that direction, he put on fresh speed and left me far behind. Perhaps he would have done as he did if the bicycle had not squeaked, but, judging from his behavior, I am inclined to think otherwise.

THE MILK SUPPLY OF CITIES.

By Prof. H. W. CONN.

THE ever-growing needs of civilized communities constantly demand new methods. At the time when the streets of Boston may have been the actual cow paths which we are sometimes told they represent, the milk problem did not exist. Every farmer owned his cows, and if some of the people in the small communities did not happen to own a cow there were plenty of these animals in their neighborhood to furnish them with milk. But as our cities have grown the farmer has been pushed back farther and farther into the country, while the demand for milk in the cities has been constantly increasing. The man of the city can no longer call upon his neighbor for milk, but must depend upon some unknown farmer living perhaps many miles away. In England the farmer still lives somewhat close to the city, and as soon as one passes the city limits he begins to find the fields and meadows covered with cows. London and Berlin draw their immense milk supply chiefly from a radius of seventy-five miles. In the United States, however, the farmer does not live so close to the cities, and the demand for milk is even greater than in Europe. Our cities must therefore depend upon a wider range of territory. New York draws its milk from a radius of some three hundred miles. It is easy to see that with such conditions many new problems have arisen. These problems, so far as they concern the obtaining of a sufficient quantity and the transportation and preservation of the milk, have, from a business standpoint, been pretty satisfactorily solved. The milk-supply companies succeed in obtaining a sufficient supply at all seasons of the year, and get it into the city in such a manner that when delivered to the consumer, even though it be forty-eight hours old, it is in tolerably good condition. But it is beginning to appear that the problem, as concerns the consumer, is a somewhat serious one, and that this problem has not yet been solved, nor is it likely to be solved unless the consumer himself takes a direct interest in it.

The problem of the milk supply in the smaller cities is quite different from that of our larger cities. In the smaller cities, even those with populations of one hundred thousand, there may be commonly found a number of milkmen who bring into the city the milk from their own farms and personally distribute it. Such a business is a small one, and the dealer and the producer may be held directly responsible for the quality of the milk. In large cities, however, the business is very different. The individual milk dealer who brings in milk from his own farm has almost disappeared, and his place is supplied by the milk-supply companies that control the product from hundreds of farms and regulate the large part of the milk which the city consumes. These companies send milk trains into the country in all directions, and collect milk from thousands of farms. The milk is brought into the city in cars in which it is cooled by ice. It may be already many hours old when it reaches the city. It is taken from the cars, and the milk from many different sources is mixed in large mixers to insure greater uniformity. It is again packed in ice, and remains thus until the individual dealer is ready to put it into his cart and distribute it through the city to the customer.

As a result of this the customer no longer knows whence his milk comes. If he is a citizen of New York, he may receive milk from his own State, or Connecticut, or Pennsylvania, or New Jersey. It may come from a thrifty farmer, or from a slovenly, filthy farm, or, for all that the consumer knows, it may come in part from a farm where there is a contagious epidemic. There is no method of tracing responsibility, no method of even knowing the source of any lot of milk. One morning we may receive milk from northern New York, and the next from New Jersey. One morning, for all he knows, it may come from a model dairy farm, and the next from the most unhygienic surroundings imaginable.

But this is to a certain extent true of other foods. We can not tell where our flour or meat comes from, or our apples or sugar. Why should we be more disturbed over milk than other foods? Indeed, until recently we have had no especial interest in the milk problem, and have taken milk as it has been offered without question, except as to its being pure milk unadulterated with water. But the rapid discoveries of bacteriology, which have shown milk to be such a good locality for bacterial growth, have been raising some very significant questions. We have been told of the countless millions of bacteria which we have been drinking daily. This has somewhat disturbed us, and no sooner have we become reconciled to this idea than we are told of the great amount of filth that finds its way into milk—two hundred pounds of cow dung being the daily ration of New York city, some one tells us. The matter appears more serious still when we are told by the public press that there are more bacteria in city milk than in city sewage, and are informed of the epidemics of typhoid which are distributed by milk, or of the prevalence of tubercle bacteria in this food product. We become suspicious of the milk supply and hesitate to use this food product or to give it to our children.

Naturally, the people in small communities feel somewhat more at ease in the matter since they know their milk producer and can hold him responsible. But it is questionable whether the milk supply of the large city is not more reliable. The milk supply in the city is handled by organizations, and these, on the whole, are rather more likely to exercise care in the treatment of the milk than are the small dealers. The advantage of handling the matter through companies is well shown in many European cities. In the large cities of England and the continent the milk business is commonly handled by concerns that distribute great quantities daily. Now, many of these companies deal with the subject in a very intelligent manner. They exercise a very considerable control over the individual dairy farms. Some of them keep inspectors traveling constantly among the farms, spending $10,000 to $15,000 yearly in such inspections. They will receive no milk from a farm until after an inspector has visited it and looked into the hygienic conditions of the dairy, even sometimes going so far as to make an analysis of the water used in the dairy. Only after such inspection has been declared favorable is the milk received in the city. These inspections are repeated monthly. The appearance of a contagious disease on the farm is noted at once and the milk no longer received, although still paid for. These companies employ chemists and bacteriologists to study the character of the milk received. They educate their men into their business, and consequently employ more intelligent help than small concerns can. They can furnish a more uniform product than can be expected of smaller dealers. They soon acquire a reputation for their milk, which they are very careful to preserve. Such firms can exercise a much more satisfactory control over the individual farmer than can even public statute, since, with their systems of inspection, it is possible to have an accurate knowledge of the actual conditions under which the milk is produced. It is plainly within the power of firms dealing in large quantities to control the character of its milk more accurately than can small dealers.

Results, too, appear on the whole in favor of the large dealers. In the cities where there is a system of rigid milk inspection it is comparatively seldom that the milk furnished by such companies is found below the standard. This milk is kept up to the standard, and the companies having a chemical laboratory and having milk from many sources can keep the quality of the milk much more uniform than can a dealer whose supply comes from a single farm. The milk inspectors usually find that it is the small dealers that fail to meet the standard. Moreover, it is a fact that where epidemics have been traced to milk it has always been in communities where individual milkmen bring in milk from one or two dairies and distribute it personally. All the epidemics of typhoid that have been definitely traced to milk have been in small communities, and none traced to the milk of large dealers. It is true that it would be difficult or impossible to trace to the milk a typhoid epidemic which might occur in a large city. No one is likely to receive the milk from the same source for two days in succession, and the mixing which the milk receives in the receiving station entirely obliterates the individual source. If there should be some milk brought to the city which contained typhoid bacteria it would be impossible to determine the fact, for such milk, after mixing, would be thoroughly scattered beyond any possibility of following it. We may, then, question somewhat the significance of the fact, but it certainly is true that while serious epidemics have been caused by milk in smaller cities no such instance has occurred in the large cities, or been traced to the milk furnished by companies that handle it in considerable amounts. It would seem that if milk has ever been the cause of such diseases in large cities there ought to have been some evidence of the fact obtained.

It is probable, therefore, that the small community can hardly feel itself any better off in regard to the milk supply than the larger city. It is, of course, easier to trace responsibility for bad milk if we know where it comes from, but it is less likely to be very bad if it comes from a large number of sources and is thoroughly mixed. The milk in the large city is perhaps forty-eight hours old when it is received by the consumer. But it has been kept on ice, has perhaps been filtered, and many of its bacteria may have been killed by the long-continued cold temperature. So far as concerns the bacteria question, our milk which is thus two days old, appears to be actually superior to milk delivered in European cities, which is only a few hours old. The free use of ice in our milk car produces a more favorable result than the more rapid handling which the milk receives in Europe. The milk company controlling a large territory, with great resources at its command, can put into practice rules which even public statute can not enforce, and which the individual farmer will rarely do by himself. One who is acquainted with the methods of handling milk in our cities finds that the companies are each year improving their methods, and that the milk is in most places becoming more reliable. The proper solution of the milk supply for our communities is in the formation of large companies, provided they are managed partly for the benefit of the public and not wholly for money-making.

There is little question that the public has become somewhat suspicious of milk, and that many hesitate to drink it as freely as in earlier years. This suspicion is more pronounced in Europe than in the United States. Upon the continent of Europe the amount of milk which is used raw is really very small, and apparently its use in this condition is destined to cease. The younger generation of physicians are now being taught that raw milk is a dangerous food, and in some countries even the children in the schools are being taught that it is not safe to drink raw milk. Such teaching can have only one result, and that is the reduction in the amount of milk consumed. Much less milk is used in Europe than in this country. It is used for tea or coffee or for cooking, and of course for infant feeding, but for any one to drink milk as we do in this country is certainly a rarity. The suspicion under which milk has been placed has decreased its use.

The dangers which are feared in milk are of course connected with the distribution of disease. Most persons who thus hesitate to use milk have simply a vague fear, without knowing just what is to be feared. When we put together all the facts in our possession we find that there is good reason for believing that milk is sometimes concerned in the distribution of the following well-known diseases and some obscure ones: The first is *tuberculosis*, which is a disease attacking the cow, and, if located in the mammary gland, may infect the milk with tubercle bacilli, and may subsequently produce the disease in the person who drinks the milk. It should be stated, however, that there is good reason for believing that the danger from this source has been overrated. Second, we have *diphtheria*, which apparently may also attack the cow. The diphtheria germs may get into the milk from the cow, and they certainly do get into the milk occasionally from secondary sources. *Scarlet fever* apparently is distributed by milk, though whether this disease may come from the cow or only by secondary contamination of the milk is not yet positively settled. *Typhoid fever* has in a large number of cases been traced to the milk supply. This disease, however, does not occur in the cow, and the germs always get into the milk from a secondary source, such as water or contact with a person who has the disease. *Cholera* may be distributed by milk, but this is of course of little importance. Of these disease bacteria, the tubercle bacillus probably never grows in milk, while the typhoid and diphtheria germs do. The most common of all troubles attributed to milk are those somewhat obscure *intestinal diseases* which attack people especially in the summer months, and are particularly common among children. Prominent among these stands *cholera infantum*. These latter troubles, according to our present knowledge, are not produced by distinct species of bacteria finding entrance into the body and growing there, as are the other diseases mentioned. They appear to be produced by bacterial poisons which are in the milk. The bacteria—probably several different varieties—grow in the milk and there give rise to certain poisonous products, and these, when taken into the stomach, produce the diarrhœal diseases referred to.

The question of more importance is, however, as to the extent of the danger from such causes. This question is much like the famous one of how large is a piece of chalk. There is danger in everything, even in drinking water and breathing air. Is the danger from milk so great as to suggest that we should give up our habit of drinking milk as they have largely done in Europe, or is this danger so slight that we can well afford to neglect it? We can not avoid all sources of disease even if we would. To do this we should need to shut ourselves up in a box, breathe nothing but sterilized air, drink nothing but sterilized water, and come in contact with no other person, to say nothing of wearing sterilized clothes. Such a method will produce physical weakness rather than vigor. We have learned in the last few years that the proper way of avoiding disease is rather by preparing ourselves to resist it rather than try to avoid all contact with possible disease germs. The question is significant, then, whether the danger from milk is so great that we should use every means of avoiding it; or is it one of the slight dangers which we may best class with the everyday incidents against which our proper guard should be simply vigorous health?

It is impossible to say how great is the liability of contracting disease from milk. Sometimes the subject looms up before us in gigantic proportions. When our papers are describing the occurrence of hundreds of cases of typhoid fever in a city, all traced to a milk supply, the seriousness of the problem is very apparent, and very likely we stop drinking milk for a season. But when, on the other hand, we remember the millions of people that are drinking milk daily without injury, and remember that our forefathers have done the same, we grow graver and begin again our old custom. No one can, indeed, pretend to say how great the danger is. That it is greater than that from drinking water is pretty clear. That it is less than that of riding in the cars is probably equally true. That it is greater in a small community than a large one seems probable, and that there is a greater likelihood of its being serious where the milk comes from a single source than where it passes through the hands of a milk-supply company appears to the author to be quite sure.

In his relation to this problem each person must decide for himself. We do not cease to ride in the cars because there is danger here, nor do the innumerable accidents from bicycling deter us from this pleasure. Ought we to give up milk because of an occasional instance of disease? It might be possible to give advice to use milk freely, looking upon the danger as a slight one and one of the unavoidable dangers of living, but if such advice is given some one will instantly declare it bad advice. It might be possible to advise boiling all milk before drinking, and again some authority would say that this is unnecessary and bad. Personally, the author, though living in a small community, uses raw milk with perfect freedom, but would regard it as unwise to allow young children, especially infants, to use it in this way.

As already stated, the agitation over the milk supply is greater in Europe than in this country. While in England milk is used much as in this country, on the continent really little milk is drunk raw, and there is a growing demand for some means which shall deprive milk of the suspicions attached to it. This demand has been rapidly growing in recent years, and has resulted in the appearance of two new industries. These are the preparation of *sterilized* and *Pasteurized* milk. Neither of these industries has as yet developed much in the United States, although in our larger cities beginnings are being made along similar lines.

Sterilized milk has been used for many years. Long ago our doctors learned to recommend, for invalids, that milk should be boiled before drinking. This was done before the matter of its relation to bacteria was understood, and when physicians simply conceived that the boiling rendered the milk more digestible. From being used by invalids it came to be suggested in feeding infants, and then, after the relation of milk to possible disease germs had been understood, the general sterilization of milk was widely recommended. The process of sterilization of milk has not taken much of a hold upon the people of this country as yet, nor has it in England. In continental Europe, especially in northern countries, where the amount of tuberculosis is very large, it has made rapid headway, and now in most of the cities sterilized milk can be bought on the streets just as easily as ordinary milk.

In sterilizing milk as it is done in Europe the destruction of the disease germs is not the only purpose. An object of perhaps equal weight is to produce a milk that will keep. There are many circumstances where it is desirable to carry milk for long distances, and to lay in a supply to last many days or even weeks. Under these circumstances sterilization is resorted to, since it preserves the milk.

There are various methods of sterilizing milk. The simplest, and doubtless the most common, is simply the boiling of the milk. This can easily be done by any one at home, and is, beyond question, very widely resorted to. But where the sterilization is to be performed by a public-supply company, boiling is not satisfactory, since the milk, although it will keep some time, is not indefinitely preserved. The common method used is heating with superheated steam. The milk is placed in bottles of special device, holding about a pint or a quart, and are placed, hundreds at a time, in a large chamber which can be hermetically sealed and then filled with steam under pressure. Here the temperature rises to 102° to 106° C. (216° to 220° F.), and is retained here for some little time. This high heat is supposed to kill all the living bacteria that may be in the milk, even the resisting spores being commonly destroyed. While the milk is still in this apparatus, and before the chamber is opened, the bottles are sealed by a mechanical contrivance and then allowed to cool. After this they are taken out of the sterilizer, and are ready for distribution. The milk thus treated is sometimes pure white, although frequently it has acquired a brownish color, which is not enticing to one accustomed to ordinary milk. Moreover, it has a taste of cooked milk, which is to some people very unpleasant. But when the method is successful the milk contains no living bacteria, and may now be kept indefinitely without further change. It may be shipped to all parts of the world, and whenever opened it will be found still sweet. The process is evidently equivalent to the canning of fruit or meat, only more difficult because the milk commonly contains many resisting spores.

Such sterilized milk can be bought almost anywhere in Europe, and there is undoubtedly a growing demand for it. Where this or other sterilized milk is used it is claimed that very favorable results follow. Careful statistics have been collected as to the number of deaths among infants from diarrhœal diseases, and it is found that in some cities the deaths from infants fed upon raw milk are nearly three times as great as among those fed upon sterilized milk. Of course, no typhoid epidemics can ever be traced to such milk, and in general its use seems to meet with decided favor.

There are, however, some serious objections to this method of treating milk, which have been and probably will continue to be sufficient to prevent its wide extension. The first is that such milk appears to be slightly less digestible than raw milk. Over this matter, however, there has been and still is a great diversity of opinion, and many claim that there is really no difference in the digestibility. It is a matter of comparatively little importance, however, at least for adults and healthy children, for the sterilized milk can be digested, and the slight difference in ease of digestion probably has little significance unless it be for weakly individuals. Secondly, the taste of the sterilized milk is that of boiled milk, and this is rather unpleasant to most people. Probably a majority of our people, if called upon to drink sterilized milk or none at all, would prefer to give it up entirely. This is really an almost insurmountable obstacle to the wide extension of the use of sterilized milk, at least for the present generation. Those who have accustomed themselves to the taste of raw milk will not drink sterilized milk, and, if they do not dare to drink it raw, will not drink it at all. If infants are brought up on sterilized milk the next generation may look upon the matter differently, since the taste can be cultivated.

The third objection to sterilized milk is its cost, which pretty effectually prevents its wide use. Here is probably the real reason why the sterilized-milk industry has not extended more rapidly than it has. The cost of the milk that has been subjected to the treatment above described is considerably above that of ordinary milk, and the size of the pocketbook is commonly a matter outweighing, with most people, even matters of health. When raw milk can be purchased at half the price of sterilized milk, or even for a cent or two less, it will be purchased almost uniformly by the bulk of people, rather than the more expensive sterilized milk. Thus it happens that, in spite of the fact that sterilized milk can be purchased easily in most European cities, the business is not a large one. Probably not one quart of sterilized milk is sold to a hundred quarts of raw milk, even in cities where the business is best developed.

There are some who think that this method of treating milk is soon to be recognized as a necessity, and that it will be shortly regarded as improper to drink raw milk as it is to eat raw pork. But the business has grown rather slowly. Most people prefer to purchase their milk raw at a cheaper price and then boil it themselves, if they do not forget it. There is, moreover, one rather serious criticism that is made against this sterilized milk. Even with the high temperature that is used, it is impossible to be sure that all bacteria spores are destroyed. In most cases they are killed, but occasionally, and indeed not infrequently, a lot of milk will contain resisting spores that the heat does not destroy. These few spores that are left may become serious, far more so than the bacteria in raw milk. After sterilization they begin to grow, and, since this milk is very commonly kept for many days before it is used, these germs have a chance to become very abundant in the milk and to produce profound chemical changes therein, in some cases actually developing poisons. The changes that thus occur may be such as to escape notice with the eye, since they do not curdle the milk, and they may even fail to affect the taste of the milk. Such milk is to all appearances good, and would be given to infants without hesitation. If it did contain the injurious products thus referred to the results would be serious. Some bacteriologists are convinced that not a few cases of serious sickness have been produced in this way. When the milk is used shortly after the sterilization this matter is of no importance, since the bacteria spores grow slowly. But sterilized milk is supposed to keep indefinitely, and is therefore likely to be preserved some time before using, giving abundant opportunity for these spores to grow.

For these several reasons there is developing a different method of dealing with the problem. It is the well-known process of *Pasteurization.* But although the process has been known for several years, its application to the milk business on a large scale is quite new. Pasteurization consists in heating the milk to a temperature of only about 68° to 85° C. (165° to 185° F.), leaving it at this temperature for a short time, and then rapidly cooling. The length of time required depends upon the temperature used, being, of course, shortest for the higher temperature, but it varies from some two minutes to half an hour. This moderate heat does not necessarily produce the cooked taste nor, as we shall see, does it involve an expense which need raise the price. The temperature, however, is not sufficient to destroy all bacteria, and for this reason is looked upon with disfavor by those who feel that what is needed is an absolute destruction of all bacteria. The Germans, who like to do things thoroughly, do not take readily to Pasteurization, and there are others besides Germans who insist that this treatment does not make the milk safe. But if one is looking for practical possibilities rather than theoretical success, there is perhaps at present more to be said in favor of Pasteurization than sterilization.

Pasteurization is found to be sufficient to destroy all the strictly pathogenic bacteria that are likely to be in milk. The germs of diphtheria and typhoid are killed, and even the tubercle bacillus is rendered innocuous by a few moments at a temperature of 75° C. The resisting spores above mentioned are of course not destroyed, and many other bacteria are left uninjured. But the bacteria which escape the heat are not strictly pathogenic, and do not grow in the body. If they produce any injury to the drinker it is because they grow in the milk and produce injurious chemical products there. They are only dangerous, therefore, after they have had an opportunity to grow in the milk for some time. This opportunity they do have, as we have seen, in sterilized milk, but they do not have the opportunity in Pasteurized milk. Pasteurized milk is not designed for keeping, and those who use it know that while the strictly pathogenic bacteria are killed the milk will not keep. It will remain sweet a little longer than raw milk, but it must be used at once. It must be treated just like fresh milk.

Under these conditions the bacteria do not commonly have an opportunity of growing sufficiently to produce their poisonous products before the milk is consumed. Practically, then, these bacteria that resist the moderate heat of Pasteurization are of no serious importance in connection with the healthfulness of milk. Pasteurized milk has been deprived of all its strictly pathogenic bacteria, and the germs still left will commonly have no opportunity to grow very much before the milk is consumed. It is therefore the confident belief of many that Pasteurization is actually a safer method of treating milk than sterilization. Moreover, the results appear to be equally favorable, for Pasteurization is claimed to produce an effect upon diarrhœal diseases equal to that of sterilization.

But the most important argument for Pasteurization seems to be that it is really practical, and can be introduced upon a scale vastly more extended than can sterilized milk. The practice of Pasteurizing milk has doubtless been followed not a little by private families, but from the very outset it has appeared that the proper method of dealing with the matter is to treat the milk at a general distributing center, rather than to depend upon the consumer to do it. Not a few devices have been suggested for accomplishing the purpose satisfactorily and rapidly. The machines invented are planned upon two different principles. In one plan the milk is placed in some large vessel holding many gallons and is here heated, commonly by steam coils. It is allowed to remain here at the desired temperature for twenty minutes to half an hour, and is then cooled. This method is necessarily slow—so slow, indeed, that it is impractical for use where large amounts of milk must be treated rapidly for general distribution. It probably could not be used for the milk supply of a city. The other method is called that of continuous flow. Here the milk is allowed to flow continuously over a heated surface, which brings it quickly to the desired temperature. It is kept hot for only a short time, however, and it then flows over a cooled surface, where the temperature is brought down again and the milk is finally delivered from the machine in a continuous stream of cooled milk. Great objections have been urged against this process, from the fact that it is not thorough. The milk is retained at the high temperature for such a short time that many of the bacteria are not killed. The Pasteurization is decidedly less thorough than by the other method. But here, again, before condemning the process it is necessary to consider its purpose. If it is to destroy all the bacteria, or as large a number of them as is possible, it is of course unsatisfactory. If, however, the purpose is to treat the milk cheaply and rapidly in such a manner as to remove the danger of disease distribution through the milk supply, it would appear that such a method is perhaps satisfactory.

So far as can be determined, this method is efficient in destroying pathogenic bacteria. Its efficiency is of course dependent upon the length of time that the milk is retained at the high temperature, and this can be regulated by the rate of the flow of the milk through the machine. All evidence we have seems to point to the conclusion that a temperature of 75° C., continued for a few minutes only, so far destroys or weakens the pathogenic bacteria which are liable to be found in milk that they need not subsequently be feared as producing disease. Of course, there are pathogenic bacteria that are not destroyed by this temperature, but they are not likely to occur in milk. The germs of typhoid, diphtheria, and tuberculosis are probably rendered harmless by such treatment, and these are the chief pathogenic bacteria of milk. Moreover, the other bacteria are very greatly decreased in numbers, so that the dangers of intestinal troubles are at least much reduced. In hospitals where Pasteurization has been adopted the results are as favorable as with sterilization.

The great value of this plan is, however, that it is practical on a large scale. In Copenhagen it has been in practice for some three years very extensively. In Denmark the amount of tuberculosis among cows is very great, somewhat more than half the animals suffering from this disease. As a result the public milk supply is regarded with more suspicion than in countries where the disease is less. It is everywhere recommended that the milk be always boiled before using, but the bother of treating the milk thus daily makes people unwilling to do it, and it is doubtful whether the practice is as common as the physicians think necessary. Some three years ago a company was organized to meet the public demand for safe milk, and it has adopted plans by which it furnishes Pasteurized milk on a scale as extensive as that of the ordinary milk-supply companies. The company has devised and manufactured two large machines which receive the milk, Pasteurize it, and cool it in a constant stream, and are capable of treating two thousand quarts an hour. The milk received by the company is tested chemically and filtered, and then allowed to pass through one of these large machines. After this it is placed in glass bottles and sealed with the company's seal. The heating is done by steam, and the cooling by brine cooled by an ammonia cooling machine. The greatest care is taken in cleaning and sterilizing the bottles, an enormous chamber some twenty feet long and six feet in diameter being used for a sterilizer. Into this the washed bottles are placed, the chamber hermetically closed, and then superheated steam is turned in upon them. Everything connected with the establishment is conducted with the greatest attention to cleanliness, and upon a very large scale. The bottled milk is subsequently distributed in ordinary milk carts. A bacteriologist is constantly testing the efficiency of the machines by bacteriological examinations of the Pasteurized milk.

The most important feature in this undertaking is that the company furnishes the city with milk at the same price as that furnished by the other companies without Pasteurization. It seems strange that this can be done, for the Pasteurization of course costs something. But the explanation is essentially that heat is cheaper than cold. Because of the subsequent Pasteurization this company does not feel it necessary to demand that the milk should reach them in as cool a condition as is required by the other companies. While their business rivals insist that they shall receive milk not warmer than 4° C., this Pasteurizing company receives it as warm as 10° C., and this saving in the cooling largely pays for the Pasteurization. The mechanical bottling enables them to employ a cheaper grade of help than is necessary when the milk is peddled in carts.

The results of this endeavor to furnish safe milk are in quite decided contrast to those connected with sterilized milk. Sterilized milk has now been on the market for quite a number of years, but, in spite of the fact that it can be readily bought in most cities, the actual business is small. The largest milk-supply company in Europe has a demand for only a few hundred quarts per day. This company in Copenhagen offers to the public a milk which has the taste of fresh milk and which has been so treated as to have all pathogenic bacteria within it destroyed, and at the same time the other bacteria greatly reduced in number. This milk it sells at the same price as ordinary milk. As a result its business has rapidly grown, and instead of supplying a few hundred quarts it sells some thirty thousand daily, and the amount of milk handled is increasing with great rapidity. It probably sells more Pasteurized milk than all the sterilized milk sold in Europe.

It would thus seem that we have here actually a practical method of dealing with the new problem of the milk supply. That it is practical is manifest from the actual results in this institution in Copenhagen. Whether it is regarded as satisfactory will of course depend upon our standpoint. Those that insist that the milk must be freed from all danger, and hence deprived of all bacteria, will not regard this method as satisfactory. But probably every one will recognize that milk thus treated is very much safer than raw milk, and that dangers from typhoid epidemics and tuberculosis are removed, even if they do not admit that intestinal troubles are thus avoided.

There can be little doubt that the method would be successful in our own cities, but its success would depend upon the price at which the milk is sold. If the Pasteurized milk is sold for a price much higher than ordinary milk it will not be a commercial success, for the vast majority of people prefer to save the one or two cents per quart, and run the rather slight risk of trouble from the milk. If it can be sold in our cities, as in Copenhagen, for the same price or a price only slightly higher than that of ordinary milk, it is hardly doubtful that it would soon come into favor, for who would not prefer milk that is safe from disease germs if the price is the same? Already there are a few attempts in this direction in some of our cities, but as yet they are only in the beginning stage. Whether they will develop to a wide extent depends probably almost wholly upon the price at which the milk can be sold.

It would appear, then, that this method of Pasteurization by a central company offers the most hopeful solution of this feature of the problem which is growing with the growth of cities. The milk companies could probably arrange, without great expense, such a plan of Pasteurizing large amounts of milk. This only emphasizes the conclusion, already reached, that the most hopeful method of dealing with the problem in our cities is through properly organized companies that can handle milk on a large scale, and will do it conscientiously, and not wholly from the standpoint of money-making.

TEACHERS' SCHOOL OF SCIENCE.

By FRANCES ZIRNGIEBEL.

[*Concluded.*]

PARALLEL in time with the course in historical geology or paleontology was that in botany, under the leadership of Dr. Robert W. Greenleaf, a Boston physician, who in his student days had assisted Dr. Goodale and was at the time of giving these lessons Professor of Botany and Materia Medica at the Massachusetts College of Pharmacy. A growing interest in the study of botany in the schools, and Dr. Greenleaf's exceptional ability as a teacher, made the attendance at this class very large. After an hour's lecture the instructor and two assistants directed the observation of the specimens by the students, who were required to make sketches of the objects studied. The first set of lessons was similar to that given in the school by Dr. Goodale several years before, and was of a preparatory nature, including morphological, structural, and physiological botany.

The introductory lesson dealt with the relation of botany to its various subdivisions and to other studies. The meaning of morphology was illustrated by comparing the four plant members—root, stem, leaf, and plant hair — with the different plant organs, and a practical exercise, with specimens whose parts were sketched and labeled, was given to show that the position and mode of development of a part determine its rank as a member or structural division, while its function may give it quite a different rank as an organ.

Robert W. Greenleaf.

A preliminary view of vegetable histology, considering the shape, wall, markings in the wall, and contents of cells, was next given. This was followed by lessons on vegetable physiology, in which the absorption of liquids and gases for the making of food, assimilation, transfer and storage of food, the growth of cells and tissues, the excretion of waste products, special kinds of work, as climbing, catching of insects, etc., reproduction, and the process of metabolism as illustrated in cells, were treated of first in a general way and then elaborated upon in the succeeding lessons. Much time was devoted to the anatomy, histology, and germination of seeds and to the structure and function of root, stem, and leaf. The morphology of fruits and their anatomical classification (profusely illustrated from the fruits of the market and neighboring fields), with a discussion of the contrivances for dissemination of fruits and seeds, furnished subject-matter for both a profitable and interesting lesson.

The last lessons of this set were devoted to the study of the flower and its parts, particularly stamens and pistils, and ended with an explanation of the processes of pollination and fertilization. The work of making vertical and horizontal plans of the flower served as an introduction for the second year's course on Systematic Botany, wherein the relations between the common families of flowering plants were shown. This course was illustrated by numerous hothouse flowers and also by dried specimens, of which one hundred kinds were given to each teacher. This course was given to teachers, many of whom could by means of a key analyze any common flower, but who knew nothing of the principles of plant relationship. The theories of special creation and of evolution were explained, and the theory of descent with variation was taken as a hypothesis.

Starting with this theory of evolution as a basis, the structure of certain families was studied and they were taken as types with which other related families were compared. After a classification of all known flowering plants into gymnosperms and angiosperms, and subdividing the latter into monocotyledons and dicotyledons, the lily family was considered as typical of monocotyledons. It and its related families afforded a simple means of demonstrating the problems under consideration. Members of this family were found to be characterized by having an endogenous stem, usually parallel veined leaves, six-parted perianth free from a three-celled superior ovary, and six stamens. The allied families were shown to agree with the type in the internal or fundamental characters, such as the number of carpels and cells of the ovary, but were found to differ in the more external or environmental characters, such as the arrangement of the parts of the perianth.

After studying the relations between the various groups of endogens, the trees and weeds of the apetalous division of exogens were next considered, and through *Ranunculaceæ* connected with polypetalous dicotyledons. These latter were classified according to whether the parts of the flower were hypogenous, perigynous, or epigynous. These terms signify, respectively, under the pistil, around the pistil, and on the pistil. In this group the rose family presented several modifications of the pistil, according to which it was divided into tribes.

When the group of *Gamopetalæ* was studied, *Solanaceæ,* the nightshade family, with its regular flower, and *Labiatæ,* or mint family, with irregular flower, were taken as types with superior ovaries. Various modifications from these types were found in several families.

Ericaceæ, the heath family, presented, in its suborders of *Ericineæ, Pyroleæ,* and *Monotropeæ,* which had superior ovaries, and *Vacciniæ,* which had inferior ovaries, an intermediate order between the preceding *superæ* and following *inferæ,* of which latter group *Campanulaceæ* was considered a type.

The relations between many families were traced, and the *Compositæ* were lastly considered, this family showing the greatest differentiation with its coalescence of circles, adnation of different circles, reduction in parts, and number of individuals brought together.

The greatest deviation from a simple flower and a complexity of structure were here presented. Through the co-operation of parts these flowers were of high physiological efficiency.

Throughout the course, families of medicinal or other economic value, or such as presented evidences of adaptation for cross-fertilization, dissemination of seed, life in desert regions, or contained examples of parasiticism or many poisonous genera, were incidentally considered.

Carefully made illustrated notebooks, collections of dried specimens, and other evidences of interest in the course were shown by the teachers, who gained great facility in placing an unknown flower in its proper family without the use of a key or botany.

The next set of lessons in the botanical series consisted of the usual number (fifteen) on cryptogamic botany. This was perhaps the course which was the most difficult of presentation; but, notwithstanding, much dried and fresh material, representing chiefly the higher cryptogams, was distributed among the pupils and examined by them.

The fourth and last year of the series was spent on paleobotany. This was a somewhat novel and valuable course, which was particularly appreciated by those who had studied geology and paleontology in other classes of the school. A large amount of laboratory material was provided from the museum. The duplicate fossil specimens of the society were used by the class, and ninety determined species were figured by many members. Since the close of these lessons persons who have shown throughout the four years a satisfactory knowledge of botany and have passed the examinations, in the most exhaustive course ever given in the subject for teachers, have received certificates stating their qualifications.

In the spring of 1887, owing to a suggestion made by Professor W. O. Crosby and to assistance furnished by him, a private course of instruction was arranged by Prof. G. H. Barton, of the Institute of Technology, for a series of lessons in field geology. Twenty-one persons, nearly all of whom had attended Professor Crosby's course in The Teachers' School of Science, took these lessons with great enthusiasm. The series of lessons was continued in the autumn, with the addition of twelve new members to the class. From this beginning has grown the systematic course of field instruction in geology now carried on as one of the regular courses. As at present conducted, it consists of a series of lessons in the autumn and spring of each year, so arranged as to give detailed instruction in methods of observation covering a range through all portions of the subject, embracing mineralogy, lithology, structural geology, historical geology, and physiography.

The method pursued is as follows: The class is taken to a typical place for illustrating the subject in hand. The area to be studied is pointed out, and then for a half hour or so the class is asked to make observations unassisted by the instructor and with as little communication among themselves as possible. Then they are called together and questions are asked to draw out the results of their observations, free discussion being invited at this time, and questions from the class answered by the instructor. Then the instructor explains the phenomena studied, and finally gives a general lecture upon the particular subject involved. Notes, taken in the field, are carried home and rewritten and then handed in at the next lesson, to be corrected and returned later. A printed synopsis is furnished each member of the class at every lesson, for which payment is made sufficient to cover the cost of the printing. Each member is also required to be provided with a hammer, chisel, and compass.

George H. Barton.

The course of instruction begins with a discussion of the general principles of erosion, and one lesson each is given at places illustrating an excess of chemical and mechanical action. At Medford a very broad dike of coarsely crystalline diabase, penetrated by numerous cracks, furnishes an exceptionally good opportunity for the observation of rapid chemical decomposition, an almost complete gradual transition being shown from the fresh unaltered rock through all degrees of decomposition to the formation of soil. The cause of the decomposition is explained, with the resulting products, and the history of the latter is traced till they form parts or the whole of a new rock. A drumlin is seen, at Great Head, Winthrop, being undermined and worn away by the waves. By comparison with other drumlins in the neighborhood, the original form of Great Head can be easily restored mentally and the effect of waves and currents upon a coast can be readily appreciated. In an excursion to North Adams and rides over the Hoosac Mountains and to the summit of Greylock, rivers are seen in their various stages of action, the cutting backward by the cascade action, the cutting downward of torrent action, and the more quiet transportation and final deposition of the streams passing through the lower levels and approaching the sea. From the sides of Hoosac and Greylock the surface of the Massachusetts plateau is seen, with its dissection by the Berkshire and Deerfield Valleys, illustrating the broad effects of erosion over the surface of the continent.

Passing next to a discussion of the disposition of the material that is derived by erosion from the land, a lecture upon the sorting action of water is given, and the resultant beds of gravel, sand, and clay are studied in a section cut by the Fitchburg Railroad through the sand plateau at Lake Walden, in Concord.

The next step is to study these products of deposition in their consolidated forms. At Parker Hill, Roxbury, a large quarry furnishes opportunity for the study of conglomerate, special attention being paid to the means of determination of stratification in a nearly homogeneous, coarse material. Here also is a large section in a drumlin left in a nearly vertical face by excavation about twenty years ago, and now illustrating finely the action of rain during the years. This forms an instructive contrast with the marine erosion of Great Head, Winthrop. Any one of the numerous slate quarries at Somerville serves the purpose of studying stratification in a fine, homogeneous material. In each of these three last-named places the various phenomena of stratified rocks are studied, such as unconformity, cross-bedding, ripple-marks, strike, and dip, but attention is confined more especially to the original structures, subsequent structures being left for later lessons.

Eruptive rocks are then taken up and studied in respect to their origin and original structures. The quarries near Winter Hill, in Somerville, furnish an admirable opportunity to study dikes. Here a small hill of slate is intersected by three series of dikes of different character and intersecting each other at various angles, enabling a determination of their relative ages. An intrusive bed, now separated from its parent dike by erosion, affords the means of comparing the characteristics of the two forms and of tracing out the relation between them. The inclined positions of the dike and bed and the numerous quarries furnish several sections in varying relations to the two. The various dikes and the inclined position of the inclosing slate give an excellent chance for the first instruction in the making of geological maps and sections. Notes are taken for this purpose, and both maps and sections are constructed and handed in at a later date.

At Marblehead Neck various other eruptive structures, such as flow structure, ancient ash-beds, etc., are seen in the felsite, of which many varieties occur there. Attention is especially called to the liability of mistaking flow structure for stratification, the similarities and differences being explained. At Marblehead Neck, also, a careful study is made of the formation of pebbles, all stages being shown from the dislodging of fragments from the cliffs by frost action, the dropping into reach of the waves, the first rounding of the sharp angles to the subangular outline, and finally the rounding of the fragment into a complete pebble form.

At Newton Centre a study of contemporaneous beds is made, including their relations to the inclosing rocks and a comparison of their characteristics with those of intrusive beds.

Eruptive masses, metamorphic rocks, and vein phenomena are all well shown at Fitchburg, where Rollstone Hill is an eruptive mass of granite cutting through the metamorphic mica schists and gneisses, and the granite in turn is cut by very numerous veins of pegmatite, abundantly rich in tourmaline crystals and occasionally having beryl.

Glacial structures are next taken up. At Newtonville is studied the esker and sand plateau, rendered famous by the work of Prof. W. M. Davis and others; at Clinton an exceptionally fine set of terraces, and the best example of *roches moutonnées* near Boston, where a class can be taught in a very few minutes to recognize that the movement of the ice sheet must have been from the north toward the south; and at Stow and Haverhill are studied drumlins.

After this, special attention is devoted to the subsequent structures of rocks, such as folds, faults, cleavage, joints, etc. Typical places, as before, are selected for each, and the work carried on in the same manner. When this course has been entirely accomplished, then places of greater complexity and where the problems are not quite so plain are visited, and opportunity is given to exercise the skill or knowledge already gained.

Following this, a series of lessons is devoted to the study of typical places illustrating the various historical strata occurring in Massachusetts; among others, Nahant and Braintree for the Cambrian, Attleboro for the Carboniferous, Mount Holyoke for the Triassic, Gay Head for the Cretaceous and Tertiary, Rockport, Martha's Vineyard, and claypits of Cambridge for the Glacial Champlain.

The work in this course has been marked by enthusiasm, and the attendance has been very large, reaching a maximum of two hundred and ten, with an average attendance of seventy-one in the autumn of 1896. As a direct outcome of this work, and connected with it, several excursions to distant points have been made by parties under the charge of Professor Barton during the summer vacations. The most important of these were the following: A five-days' trip through western Massachusetts; a seven-weeks' trip to the Pacific coast, including visits to the Lake Superior copper regions, the Yellowstone Park, Butte, Montana, Great Shoshone Falls in Idaho, Columbia River, Mount Hood, Frazer Cañon in British Columbia, the Great Glacier of the Selkirks, and the Hot Springs at Banff; and two trips through Nova Scotia, one in 1894 and another in 1898. In each of the latter trips special attention has been paid to the various kinds of mining coal, iron, and gold, to the famous mineral localities like Cape Blomidon, and to the general geology.

Also, connected with this work, a special course of lessons has been given by Professor Barton each spring to a class from the

TEACHERS' SCHOOL OF SCIENCE. FIELD CLASS IN GEOLOGY. PROF. GEORGE H. BARTON, INSTRUCTOR.

Boston Normal School, and many occasional lectures and field lessons to the classes of the State Normal School at Framingham, and at other schools, teachers' clubs, etc. During the Boston exhibition of the cyclorama of the volcano of Kilauea, Hawaii, over three hundred teachers and a large number of schools visited that exhibition and listened to personal lectures by Professor Barton in direct connection with the work of The Teachers' School of Science.

Owing to the request of members of the field class, a private class was organized in the winter for a course of twelve lessons in mineralogy. This proving successful, and a demand for laboratory work being shown, this work was incorporated as a distinct course in the school. It was during the early part of this work that Professor Barton introduced for the first time in The Teachers' School of Science the system of daily and final examinations—a system since followed as the general practice of the school and now considered as one of its most fundamental features.

This course, after various experiments, has finally developed into a definite four-years' course of instruction, at the end of which those members who have met all the requirements receive the diploma of the school. The full four-years' course is designed to give a thorough training in the fundamental principles of geological science. Each year is given a series of fifteen lessons of two hours each, partly laboratory, partly lecture, and fully illustrated with specimens and diagrams. The first year's work is devoted to mineralogy. One introductory lecture is given on the principles of chemistry as the basis of understanding the composition of minerals, and the four following lessons are devoted to a study of the physical properties, mainly crystallography. During the remaining lessons, about one hundred and fifty of the commonest mineral species are studied, the class being required to learn to recognize each species and be able to tell its composition.

The second year's work with lithology is carried on largely in the same way as with mineralogy. At first a brief review is made of the most important rock-forming minerals. Then all the commoner species of rocks are taken up and studied, so as to learn to recognize each species at sight and to tell its composition. Besides this, lectures are given upon the origin of the rocks and the derivation of their component materials, involving a large amount of dynamical geology.

During the third and fourth years are taken up, respectively, structural and historical geology. Both these subjects are taught largely by lectures, illustrated by charts and diagrams, a select set of specimens for the table, and a few such specimens as can be passed around the room. In the historical geology special care is taken to furnish for class use as many specimens as possible of the typical rocks and fossils of the various ages. It is nearly impossible to provide so abundantly, however, as for mineralogy and lithology. As regards examinations, the methods used are as follows: The first half hour of each exercise is taken up with answering questions or identifying specimens, the examinations in all cases being written. The ground covered by each examination includes all that has been gone over during that year previous to the examination. After the examination is finished, the instructor briefly answers and explains the questions. The papers so handed in are marked by the instructor and returned the following week. All of this serves to enable the class to keep a comprehensive grasp of the subject constantly in hand. At the end of each year's work a final examination of three hours in length is given, covering the complete subject. The final rank given each member is made up equally from an average of the term's work and the final examination. This course has proved decidedly popular. The instruction was originally given in the Geological Department of the Institute of Technology, in a room adapted to seating thirty-six persons. This was gradually crowded to accommodate fifty-six persons. At the beginning of the last four-years' course the number of the applications was so large that each applicant was required to sign a printed statement promising to be present at all exercises for the four years, except for good and sufficient reasons. One hundred and seventeen persons gave the required promise. In order to meet this demand, two divisions were formed, and on each Saturday afternoon the same lesson was repeated. In order to defray the additional expense of the second division the members of the class voluntarily contributed three dollars each. The labor of repeating the lessons on the same afternoon proving too great, provision was made the second year to transfer the instruction to the large lecture hall of the Natural History building, where accommodations were made for one hundred and twelve students. The work has since been carried on there, and a complete new set of specimens, diagrams, etc., is gradually being obtained.

The membership of the class is, of course, principally made up from Boston and the towns immediately surrounding, but a few come from places as far distant as towns in Connecticut and Rhode Island, from Bridgewater, Scituate, Framingham, Fitchburg, Lowell, Lawrence, and Beverly.

One member of the class has made an exhaustive study of the granites of eastern Massachusetts, and others are teaching geology in secondary schools outside of Boston.

An important and influential outcome of the first lessons of Mr. Barton was the formation, in the fall of 1888, of the Barton Chapter of the Agassiz Association, by seven ladies who had been fellow-students in mineralogy. Later, men and other ladies who had attended Mr. Barton's field lessons were invited to join. For ten years this club has flourished, and held weekly evening meetings for nine months of the year, at which the members have done much systematic work in the study of geology, mineralogy, chemistry, botany, entomology, and zoölogy. At some of the sessions the individual members have taken their share of the work by the preparing of exhaustive papers which have been read to and discussed by the class, and sometimes a series of lessons has been given by specialists in the several departments. Many of the first scientists of Boston have aided this association by the giving of lectures and advice regarding courses of lessons and opportunities for study, while the club has in return been a great benefactor to many who sought its instruction and the association of those with like tastes. In arranging regular Saturday outings for the study of field geology and botany, this club was the pioneer in this vicinity of the kind of study which happily now seems to be fast becoming popular. A number of persons who were members of this association in their younger years are now holding positions in the United States Geological Survey or other departments of the Government, or in the capacity of curator or instructor are connected with large museums, colleges, or schools in different parts of the country, thereby having

FIELD CLASS IN ZOÖLOGY. LOOKING FOR SHORE LIFE AMONG THE BOWLDERS AT WOODS HOLE.

opportunities to continue their favorite lines of work, to spread a knowledge of the things about them, and to induce in others tastes such as were fostered in them while connected with the Barton Chapter of the Agassiz Association.

Since closing the four-years' course in botany Dr. Greenleaf has repeated the lessons on vegetable morphology and physiology and those on systematic botany. Finding the class not so well prepared as in former years, instead of continuing the third course of the series, he has given a set of fifteen lessons on the elementary structure and function of flowering plants, as he believed that course to be a necessary foundation for further botanical study.

Another feature of The Teachers' School of Science should not remain unnoticed. It consists of effective work in zoölogy and geology by Mr. A. W. Grabau, the official guide in the museum and a graduate student of geology. A course of lessons on The Shore Animals of New England was begun by him in April, 1897. Directly connected with these field lessons was held a class in laboratory work, which was attended by about twenty persons.

The next year Mr. Grabau endeavored to give his audience a comprehensive view of the action of cold and heat, of winds and waves, rain and rivers, and of the chemical effect of the atmosphere in the production of the natural features of the earth's surface, by giving eight lectures on The Surface of the Earth, its Rocks, Soils, and Scenery. Special attention was given to the scenery of New England, and this awakened an interest in local scenery, which interest led to Mr. Grabau giving several lectures in surrounding towns, under local auspices. One of these lectures called the attention of the people of Arlington, Massachusetts, to the fact that they had in their midst a valuable geological monument, and led them to start a movement for the preservation of a terminal bowlder moraine on Arlington Heights, which is the only good accessible example of such moraine near Boston.

Under the same instruction ten lessons were given on the use of the microscope and the preparation of specimens of hydroids.

The work begun at the winter lectures was continued during the spring by excursions to the seashore. The beaches of Revere, Swampscott, Marblehead; the cliffs and tide pools of Nahant, Marblehead Neck, and Nantasket, and the mud flats and piles of Beverly, were explored. One excursion was made to the outer shore of Cape Cod and Buzzards Bay. The party spent four days on this excursion.

During the early part of the summer an outing was made to Bayville, Maine, where a laboratory was furnished, with microscopes and other accessories, and fourteen persons (mostly teachers) devoted ten days to the study of marine fauna, special attention being given to hydroids. Some geology was studied during this excursion, and a small island mapped. Those who attended this expedition were delighted with an experience new to most of them, as many of them had not before studied zoölogy and knew not what a field could be opened by the study of natural history. One of the party afterward remarked, "I feel as if I had been born into a new world, so different are these things in their homes from their representations in books."

In the autumn and following spring field lessons were given on marine zoölogy, the object being to study animals in their natural habitats. Another excursion was made to Woods Hole, Buzzards Bay, and a summer laboratory established for ten days at Goldsborough, Maine, where work similar to that done the previous summer was here carried out. Among the field lessons of the spring of 1899 was an excursion of four days' duration to Cuttyhunk, one of the Elizabeth Islands, where there was an opportunity to study a marine fauna southern in character and different from that found on the Maine coast. On the afternoon of Agassiz's birthday a sail was taken to another of this group of islands—Penikese, the site of the famous summer school. In the evening the class of seventeen persons listened to the reading of selections from the life of Agassiz, poems regarding him, and magazine articles describing events connected with the great meeting in the summer of 1873. The next day an excursion was made to Gay Head, Martha's Vineyard, where the afternoon was spent in studying the wonderfully colored clay cliffs and in searching for fossils. As an outcome of Mr. Grabau's field lessons the Hale House Natural History Club was formed. This club consists of teachers and other persons who have banded together for the study of natural history. Meetings are held twice a month, and similar classes have been formed for children of the neighborhood.

The Teachers' School of Science has been of great assistance to the Boston Normal School by furnishing certain of its pupils with instruction in geology and zoölogy.

In 1893 The Teachers' School of Science took part in the exhibition of elementary science teaching made by certain teachers of the schools of the eastern part of Massachusetts. The school was enabled to take part in this public exhibit through the generosity of Mr. T. A. Watson, a pupil in the school, who paid the necessary expenses.

A collection of articles obtained by the Baron de Baye in a scientific expedition last year to Siberia and the Russian Caucasus contains specimens from very ancient times down. Among them are mammoth bones and chipped flints, like those of the Mousterian period in France, from the Yenisei; arrowheads, like the European and American, from the same region; bronze weapons from the Caucasus; iron arrowheads like those of the Congo; skulls, weapons and ornaments, necklaces of hard, polished, pierced stones, from the Kurgans of the steppes, dating from antiquity down to the beginning of the middle ages; Caucasian jewels, and ceramic ware ancient and modern. A very curious object is one of the statues, called Kamenaia Baba, of a kind supposed to have been set up by the Scythians and always held in veneration, of which the present specimen is the only one yet allowed to go out of Russia.

INFLUENCE OF THE WEATHER UPON CRIME.

By EDWIN G. DEXTER.

THE relation between general climatic conditions and the prevalence of suicide has been somewhat exhaustively studied by students of criminology, the result being a considerable accumulation of data and the formulation of a number of more or less tenable theories. From these studies we may safely conclude that the homicidal tendency, as shown by self-destruction (suicide) and the destruction of others (murder), is stronger in the temperate climatic zones than in the torrid or frigid, and that in the late spring and early summer months more of these offenses have been recorded than for any other period of the year. To these few facts the seeming effects of cosmical forces upon such tendencies has apparently been limited.

It fact, it was the oft-repeated statement that nothing was known of the exact relations of the more definite meteorological conditions with the prevalence of suicide—a statement to be found in most treatises upon the subject—that has given rise to this paper. Realizing that the science of climatology must include, and in fact be based upon, a study of the meteorological conditions prevalent, and that the study of these definite conditions for the exact times when suicides or murders occurred might throw some light upon the question, this problem was undertaken.

In the preparation of the accompanying charts, from the study of which the conclusions herein stated were deduced, the record of crime for Denver, Colorado, for the fourteen years ending with June, 1897, was made use of. Superintendent Howe, chief of the city detective service, has kept such a record with the greatest care, and we wish here to acknowledge the many courtesies of his office.

No attempt has been made in this paper to compare the conditions for Denver, either meteorological or social—and each is somewhat unique—with such conditions elsewhere. In fact, such a comparative study is at present impossible since data are wanting.

In the actual preparation of the charts each murder, suicide, or attempt at suicide—which, for our purpose, is equally important—was set down chronologically in the left-hand columns of large sheets of paper ruled for the purpose. These sheets were then taken to the office of the United States Weather Bureau, F. H. Brandenburg, director, where were recorded in the proper columns the maximum and minimum barometer readings, maximum and minimum temperature, maximum and minimum humidity, maximum velocity of the wind, precipitation, and character of the day for each day during the fourteen years on which a crime of either class occurred. When several took place upon the same day the fact was taken into consideration. From the sheets thus filled out, the curves on the accompanying charts were plotted by computing the

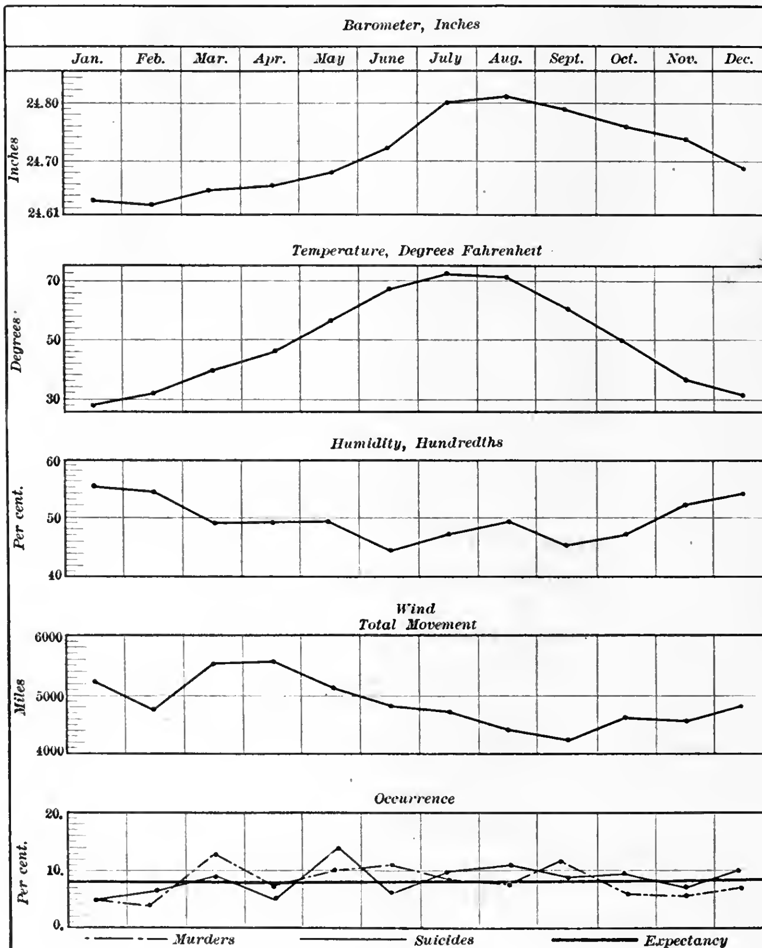


FIG. 1.

per cent of crimes of each class committed under the definite meteorological condition indicated.

The curves marked "normal" were constructed by tabulating in a similar manner the conditions for every day in a sufficient number of days to secure a fair average. Five years were so tabulated for Figs. 2, 3, 4, and 5, and the records for nineteen years used in Figs. 1 and 6.

The whole number of suicides recorded is two hundred and sixty;

murders, one hundred and eighty. It may be noted that this number of suicides, for a city averaging hardly one hundred thousand inhabitants for the fourteen years, is largely in excess of the rate recorded for American cities, but it must be remembered that some of these were unsuccessful attempts, and also that the social conditions of Denver tend to swell the number—containing, as it does, so many disappointed in the last struggle for health.

Fig. 1 shows the occurrence, in per cent, of crimes of both the classes considered for each month of the year, together with the monthly meteorological means, computed from the records for nineteen years. The expectancy curve in the occurrence table is based upon the supposition that the months of the year are all of the same length, and that the numerical expectancy would be one twelfth, or eight and a third per cent for each. It will be seen that the crime curves are for the most part below the expectancy for the winter months, and above it for the summer (except for April, and suicides for June), showing the maximum for the latter class in May and for murders in March. Morselli shows * that for most European countries suicides are at the maximum in June, though a considerable number show that condition for the later spring months. A study of the general meteorological means, shown upon the same plate as the occurrence table, fails to indicate any good reason for irregularity of the crime curves. The "month" columns read from the top to the bottom of the chart, and by following that for May, for instance, which month shows the maximum for suicide, we find that the meteorological condition for each class of data is about halfway between the extremes for that class for the year, while for January (minimum suicides) each class is by far more divergent. Yet a mean, like those considered in this table, is but the average of the extremes, and those months which show great per cents of crime also present great extremes of condition, which fact, interpreted in the light of those disclosed by the charts yet to be considered, make the occurrence curve more explicable.

Wind.—An explanation of the various curves in Fig. 2 may serve for the series following, so I give it somewhat in detail. The vertical distances from the base line indicate per cents, and the distances from left to right, divided into columns, the maximum velocity of the wind per hour for the days tabulated. In the "normal" curve every day for five years was considered, and it was found that seven per cent of the days for that period showed a maximum velocity of between one and ten miles (first column), forty-eight per cent a maximum velocity of between ten and twenty miles (second column), nineteen per cent a maximum velocity of between twenty

* Suicide, International Science Series.

and thirty miles, and so on, as indicated by the curve. Now, it can readily be seen that this normal curve may also be considered the expectancy curve—*if the wind has no effect.* That is, if forty-eight per cent of the days of the year show a maximum velocity of the wind, between ten and twenty miles an hour, the law of probability would give us the same per cent of the crime for the year on such days if this meteorological condition were not effective.

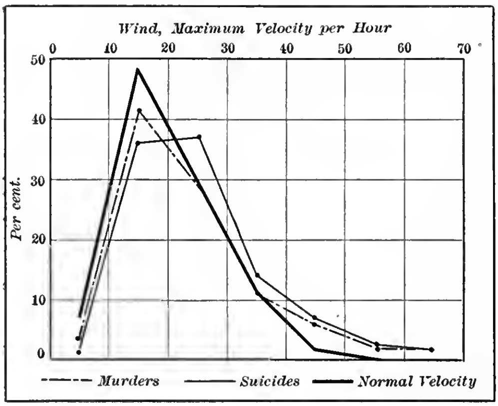


Fig. 2.

What we do find, however, is indicated by the other curves, and any increase of crime over expectancy may in this case be ascribed to the wind. We notice that for slight velocities (one to twenty miles an hour) the crime curves are below that of expectancy, but we can see that if the sum of all the per cents for any one curve is one hundred, and one is forced above the other at any part, there must be a corresponding deficiency at some other part. So we may, perhaps, with justice suppose that these mild velocities do not exert a positively quieting effect emotionally, but simply a less stimulating effect than the higher ones. For velocities of between twenty and thirty miles a marked effect is noticeable, and under those conditions the proportion of suicides to that expected is 37 : 29; velocities of from thirty to forty miles, 14 : 11; of forty to fifty miles, 7 : 2; of fifty to sixty miles, 0.4 : 2.6; of fifty to sixty miles, 0.2 : 2. The curve for murders shows the increase to be slightly less than for suicides, but the same general relation is preserved throughout. The value of such curves is, of course, somewhat proportional to the number of observations made and recorded, and we must confess that two hundred and sixty (suicides) and one hundred and eighty (murders) is a hardly sufficient number from which to deduce a definite law, but we can hardly doubt, even considering this somewhat limited number, that the wind is, in our problem, a factor of no mean importance.

Temperature.—Fig. 3 is intended to show, in a similar manner, the relation between expectancy curves, based upon conditions of temperature, and the actual occurrence of the crimes in question. With this class of data, as well as that for the barometric readings and humidity (Figs. 4 and 5), both the maximum and minimum readings are considered. This was done instead of taking the mean of both for the day, since in many cases the latter might be quite normal, while one or possibly both the former might exhibit marked peculiarities. All the curves were constructed precisely as in the chart just considered, and those marked "normal" are again the expectancy curves. An inspection of the chart shows no marked discrepancies till we reach the higher temperatures. For the lower the coincidence for all the maximum and all the minimum curves is not exact, but somewhat similar. When, however, we reach for the minimum curves, temperatures of from 40° to 50° and from 50° to 60°, which means that for the per cent of days indicated, the temperature did not go below those points, the per cent of crime exceeds that expected under the conditions in the proportions of 22 : 16.5 and 24 : 18 (suicides), and 21 : 16.5 and 29 : 18 (murders).

The same general relation exists between the maximum curves, where it is shown that for temperatures between 80° and 100° the actual crime is about thirty-three per cent in excess of the expected.

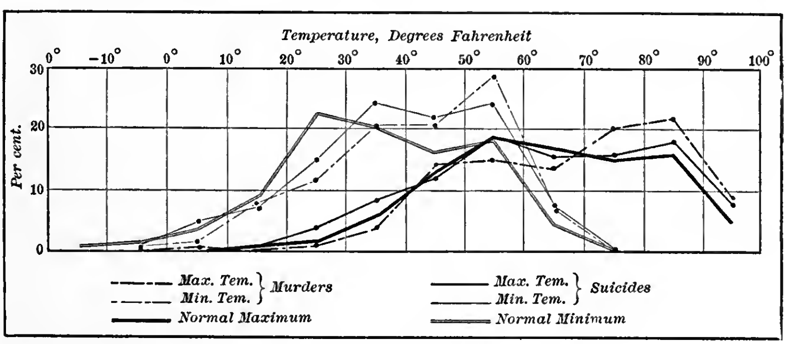


Fig. 3.

These facts have their bearing upon the already noted statement that the summer months show a preponderance of homicide.

Barometer.—Fig. 4, disassociated from the others, shows but little. Naturally we should not look for very marked effects from variations of an inch or less in the barometric readings, when in the course of a journey from the sea level to Denver a change of six inches is brought about, and in going from the same point to the summit of Pike's Peak one of nearly twelve inches without producing any marked emotional abnormities, but we must take into consideration the fact that sudden barometric variations generally accompany or more frequently precede other important meteorological changes. In the latter case, though they might be the primary cause of factors considered in this study, they themselves would fail to show upon the tables.

HUMIDITY.—This figure (Fig. 5) indicates in a very decisive manner that states of low relative humidity, as shown by both maximum and minimum readings, are conducive to excesses in both the

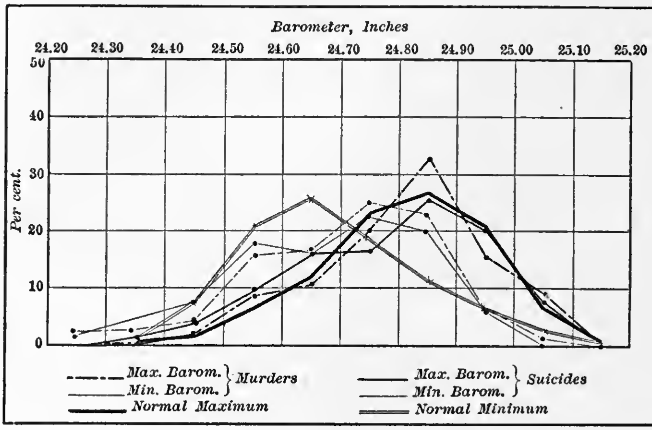


FIG. 4.

classes of crimes studied. For instance, for maximum humidities between ten and twenty the proportion of actual crime to that expected is 1 : 0.1; between twenty and thirty (suicide), 11 : 1; between thirty and forty, 9.5 : 4.5; between forty and fifty, 15 : 8. The maximum curves show somewhat the same general relation though not with quite so marked divergences. To one who has experienced the general low humidities of our Colorado altitudes

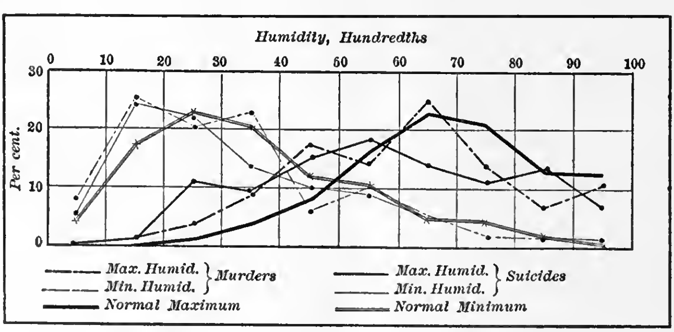


FIG. 5.

(Denver is one mile above the sea level) this result is not surprising. There is no doubt that a nervous tension much in excess of that common in the lower altitudes exists, due in part, perhaps, to the deficiency in barometric pressure and a consequent effect upon the respiratory processes, but probably, as shown by these curves, more largely to the dryness of the atmosphere, as indicated by low humidity. I hope at some future time to verify or disprove this supposition by a comparative study made at some lower altitude.

CHARACTER OF THE DAY.*—Fig. 6 shows the relation between the expectancy of crime, based upon the actual per cents of cloudy, partly cloudy, and clear days (records of nineteen years), and its actual occurrence. The disagreements are very slight, although a slight excess of murders is shown for cloudy days.

SUMMARY.—Fig. 1 shows at a glance no generally prevailing meteorological conditions to which can be ascribed, with any degree of certainty, the monthly variations of crime.

Fig. 2 shows that high velocities of wind seem to increase to a marked extent the tendency to crime. For the highest velocities increasing the probability twenty times (two thousand per cent).

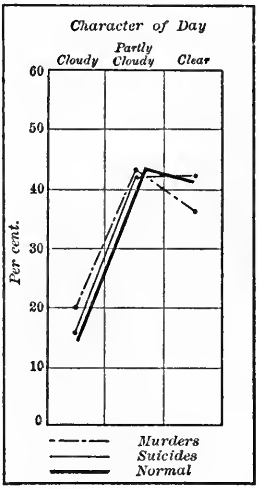


FIG. 6.

Fig. 3 shows that high temperatures seem to have the same effect, that of between 90° and 100° increasing the probability one hundred per cent.

Fig. 4 fails to show that barometric changes are accompanied by any marked excesses in crime.

Fig. 5 shows that low conditions of relative humidity are attended with very marked excesses, those below thirty increasing the probability of suicides eleven times (eleven hundred per cent).

Fig. 6 fails to show that the character of the day has any considerable effect.

Considering briefly, in conclusion, the results of the foregoing study, and comparing them with a somewhat similar one for children,† we may safely conclude that the tendency to homicide varies with those meteorological conditions which bring about an emotional state necessitating a considerable discharge of motor stimulus. The same conditions which bring about irritability and unruliness on the part of the child accompany suicidal tendencies.

This supposition is upheld by the fact that suicide is less common in the colder climates, where the metabolic processes are slow, and

* By the United States Weather Bureau days are characterized as "cloudy" when for 0.8 or more of the possible hours of sunshine the sun is obscured; "partly cloudy" when from 0.4 to 0.7 inclusive is obscured; and "clear" when 0.3 or less.

† See The Child and the Weather, Pedagogical Seminary, April, 1898.

in the torrid zone, where the heat produces a general depletion of energy for motor discharge, than in the temperate regions, where the climate is exhilarating. The study, from the social standpoint, too, leads us to the same conclusion. The excess of crime in the social whirlpools of our great cities is convincing, and especially the careful study made by Morselli of the prevalence of suicide in the different countries of Europe, interpreted in the light of what we know of their social conditions.

Yet, in considering the facts disclosed by the present paper, we must not dogmatically assert that each is of the importance that the figures indicate. In fact, it seems evident from a careful study of the sheets, which show all the conditions together for the same day—a thing impossible with the charts illustrating this paper—that the various conditions for the day mutually react and interact upon one another, certain combinations seemingly resulting in a re-enforcement of the tendency to crime, while certain others inhibit it. Space forbids any full discussion of this phase of the problem in the present paper, but it very probably will be made the subject of some future study.

Author's Note.—The above paper was written more than a year ago. Since that time the work of comparing the prevalence of crime with the meteorological conditions has been carried on upon a much larger scale in the city of New York. An immensely greater number of data have served to corroborate the earlier conclusions arrived at in this Denver study, only in minor points—and those directly traceable to the very different climates—proving at all in opposition to them.—New York, *July, 1899.*

THE SURVIVAL OF AFRICAN MUSIC IN AMERICA.

By JEANNETTE ROBINSON MURPHY.

FIFTY years from now, when every vestige of slavery has disappeared, and even its existence has become a fading memory, America, and probably Europe, will suddenly awake to the sad fact that we have irrevocably lost a veritable mine of wealth through our failure to appreciate and study from a musician's standpoint the beautiful African music, whose rich stores will then have gone forever from our grasp.

During my childhood my observations were centered upon a few very old negroes who came directly from Africa, and upon many others whose parents were African born, and I early came to the conclusion, based upon negro authority, that the greater part of their music, their methods, their scale, their type of thought, their dancing, their patting of feet, their clapping of hands, their grimaces and pantomime, and their gross superstitions came straight from Africa.

Some of their later songs, it is true, we must technically call "modified African," but how far the original African song elements have been altered (and usually not for the better) by contact with American life is a question of fact, and can only be settled by a careful comparison of the songs as sung among the natives of Africa and the changed forms in which their modified ones are found today in the South. It must be determined in each case, and can not be settled by any general theory or formula.

This question of the classification of African music has given rise to more or less discussion. It seems hardly just to call the genuine negro songs "the folk songs of America." We are a conglomerate people, and no one race can claim a monopoly in this matter. English, Scotch, German, French, Italians, and others have brought their own music and their own folklore, and in each case it must be considered distinctly belonging to the nationality that imported it. Why should not the same be true of the genuine negro music? The stock is African, the ideas are African, the patting and dancing are all African. The veneer of civilization and religious fervor and Bible truth is entirely superficial. The African is under it all, and those who study him and his weird music at short range have no difficulty in recalling the savage conditions that gave it birth.

Were I to begin now the study of all the intonations and tortuous quavers of this beautiful music, I fear I should be able to do little toward imitating it; for it was only possible to catch the spirit of it and the reason of it all while my voice had the flexibility of childhood, and the influences of slavery were still potent factors in the daily life of the negroes. I followed these old ex-slaves, who have passed away, in their tasks, listened to their crooning in their cabins, in the fields, and especially in their meeting houses, and again and again they assured me the tunes they sang came from Africa.

Possibly I have an unusual predilection for this imported African music, but to me some of the strange, weird, untamable, barbaric melodies have a rude beauty and a charm beside which, as Cowper says—

"Italian trills are tame."

It is indeed hard to account for the strange misconceptions which prevail as to what really constitutes genuine African music. The "coon songs" which are so generally sung are base imitations. The white man does not live who can write a genuine negro song. At home there used to be a rare old singer, an old Kentucky mammy, whom everybody loved. She once said: "Us ole heads use ter make 'em up on de spurn of de moment, arter we wrassle wid de Sperit and come thoo. But the tunes was brung from Africa by our granddaddies. Dey was jis 'miliar songs. Dese days dey calls 'em ballots, but in de ole days dey call 'em spirituals, case de Holy Spirit done revealed 'em to 'em. Some say Moss Jesus taught 'em, and I's seed 'em start in meetin'. We'd all be at the 'prayer house' de Lord's Day, and de white preacher he'd splain de word and read whar Ezekial done say—

"'Dry bones gwine ter lib ergin.'

And, honey, de Lord would come a-shinin' thoo dem pages and revive dis ole nigger's heart, and I'd jump up dar and den and holler and shout and sing and pat, and dey would all cotch de words and I'd sing it to some ole shout song I'd heard 'em sing from Africa, and dey'd all take it up and keep at it, and keep a-addin' to it, and den it would be a spiritual. Dese spirituals am de best moanin' music in de world, case dey is de whole Bible sung out and out. Notes is good enough for you people, but us likes a mixtery. Dese young heads ain't wuth killin', fur dey don't keer bout de Bible nor de ole hymns. Dey's completely spiled wid too much white blood in 'em, and de big organ and de eddication has done took all de Holy Spirit out en 'em, till dey ain't no better wid der dances and cuttin' up dan de white folks."

The negro usually sang religious music at his work. He was often turned out of church for crossing his feet or singing a "fiddle sing," which is a secular song, but he could steal all the chickens he wanted and never fall from grace. One of the most persistent fancies that the old slaves cherished was that they were the oppressed Israelites, that the Southerners were the cruel Egyptians, and that Canaan was freedom. Bondage was of course their slavery. They believed that some day the Red Sea would come in a sea of blood, which was verified in the civil war. In many of their songs they appropriate Bible prophecies and ideas to themselves. The song given on the opposite page is a characteristic one, illustrating many peculiarities; and if it did not come from Africa, where did it come from?

It is often asserted at the North that, as a rule, the negro was punished if he prayed or received religious instruction. On the contrary, many fine plantations had their "prayer houses," where a white minister was employed to hold services and to instruct them in the Bible. In nearly every section they were permitted and encouraged to hold their own meetings. That this is true is attested by these same thousands of "spirituals," all of which are filled with

Bible texts. Some of the most devout Christians were, and are yet, the old "mammies" and "uncles" who lived all the closer to the heavenly Father because of their simplicity and lack of learning. The deeply religious and better class of old negroes maintain that the reason that this music is so fascinating to whites and blacks is because it is God's own music inspired by the Holy Spirit.

DONE FOUND DAT NEW HIDIN' PLACE.

There is indeed a wonderful power in some of these songs, and the charm undoubtedly lies in the fact that they are founded on Bible texts.

No one questions the remarkable hold the genuine negro music has upon the Anglo-Saxon race, as is evidenced by the success of the Jubilee singers years ago and of the Hampton students now. The negroes have simply used the weird African melodies as a fascinating vehicle for Bible truths.

Most students of English hymnology have observed a similar fact in their own religious poetry. One of the most powerful devotional hymns in the language—How Firm a Foundation, ye Saints of the Lord—is largely indebted for its perpetuity to the fact that almost every line is taken directly from the Bible.

To illustrate the power of this music upon the colored people themselves, I may be permitted to give this little bit of personal experience:

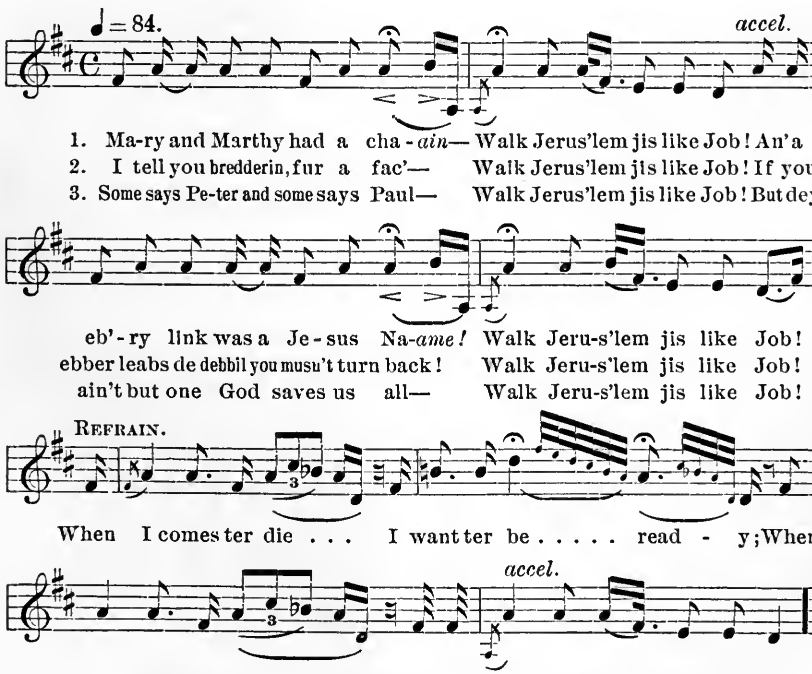
A few nights ago I went to pay a visit to an old "mammy" from Charleston. All her family sat round the room when they found I was from the South. The eldest daughter said: "Bress de Lord! I'm glad to see you! The Norf am no place for people what's been used to eberyting. Nuffin but wuk, wuk, wuk; all's jes money. No fun, nor lub, nor Jesus Christ nowhar! Why, dey'll jes meet you and pass de time ob day, and dey'll let you go away widout eber stoppin' to ax yer ef you's prepared to die, and how's your soul. Why, I neber seed no stranger in Charleston 'thout axin' 'em how's der soul comin' on? De niggers heah ain't got no Holy Spirit and dey is singing no 'count songs—dese white songs from books."

At this juncture I quietly began to sing, "I don't want to be buried in de Storm." Suddenly they all began to sing and pat with me, and quickly adapted their different versions to mine. They lost no time in getting happy. They all jumped up and down in a perfect ecstasy of delight, and shouted, "I feel like de Holy Spirit is right on my hade!"

Another one exclaimed: "People! dem songs makes de har rise up. Mine a-risin' now."

We all had a good time, and I felt greatly complimented when the head of the house explained enthusiastically: "You does shore sing 'em good; and for a white lady you is got a good deal ob de Holy Spirit in you, honey"; and before I left the house they had tried to convince me that God has surely blessed this music by taking a hand in forming it himself.

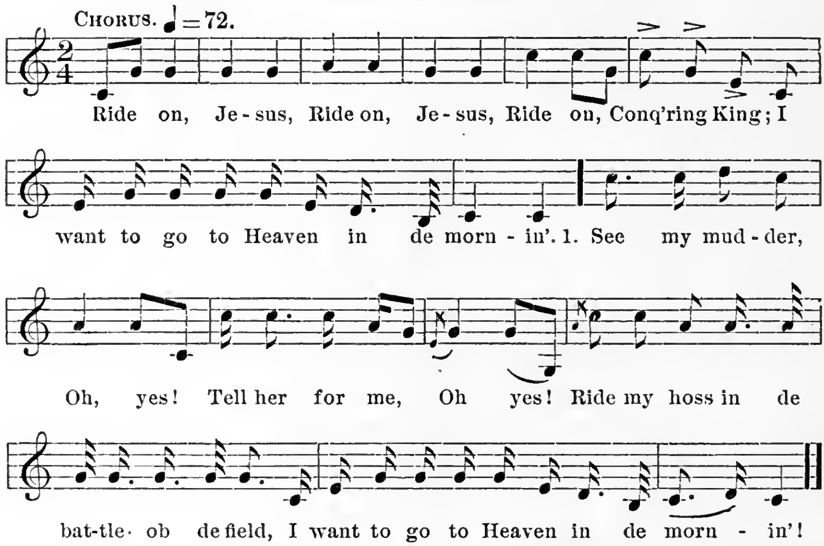
We find many of the genuine negro melodies in Jubilee and Hampton Song Books, but for the uninitiated student of the future there is little or no instruction given, and the white singer in attempting to learn them will make poor work at their mastery; for how is he, poor fellow, to know that it is bad form not to break every law of musical phrasing and notation? What is there to show him that he must make his voice exceedingly nasal and undulating; that around every prominent note he must place a variety of small notes, called "trimmings," and he must sing tones not found in our scale; that he must on no account leave one note until he has the next one well under control? He might be tempted, in the *ignorance* of his twentieth-century education, to take breath whenever he came to the end of a line or verse! But this he should never do. By some mysterious power, to be learned only from the negro, he should carry over his breath from line to line and from verse to verse, even at the risk of bursting a blood-vessel. He must often drop from a high note to a very low one; he must be very careful to divide many of his monosyllabic words in two syllables, placing a forcible accent on the last one, so that "dead" will be "da—*ade*," "back" becomes "ba—*ack*," "chain" becomes "cha—*ain*."



He must also intersperse his singing with peculiar humming sounds—"hum-m-m-m." He will have to learn that the negro never neglects his family relations in his songs, and seldom considers his "spirityul" finished until he has mentioned his father and mother and sister and brother, and his preacher.

A beautiful custom prevails among them of sending messages by the dying to friends gone before into heaven. When a woman dies some friend or relative will kneel down and sing to the soul as it takes its flight. This song contains endless verses, conveying love and kisses to Aunt Fannie and Uncle Cæsar and "Moss Jesus." With omissions it is used upon other occasions with fine effect.

RIDE ON, JESUS.



Old Mary, who sang this, was a nurse in our family. She, like most negroes, had no idea how old she really was. She never worried, though the heavens should fall, and this ignorance as to when their birthdays rolled round may account for their longer lives here and in Africa, and for their not showing their age. She found great difficulty in arranging her religion to suit her morals, and once, in my childish innocence, I remonstrated with her for getting "baptisted" so many times, and she exclaimed indignantly: "I's a Methodist wid a Baptist faith. I gits baptisted ebery summer when de water am rale warm, and I gits turned out ebery winter fur dancin' and stealin', and you would too, child, ef you was a nigger."

A few days ago I asked one of the most scholarly and noted ministers of the colored race, who was visiting in New York, about the negro music. He is very black, and his parents were pure Africans. He said that undoubtedly the tunes came directly from

Africa, that his father said he had sung them at home in Africa, and that the tunes were almost supernatural in their hold upon the people. He continued: "Upon condition that you will never tell my name, I'll give you an incident which will prove to you that many of our race are still under the influences of voodooism, and that although I am, as you see, a professed Christian, all the African practices hold a powerful charm for me which I can't shake off." Knowing well his reputation and position, I was startled. He went on and said: "And this may serve you some time, as it is a true story of my own weakness. Once the bishop ordered me to the city of ——, where I was to have charge of a run-down church. The first prayer-meeting night the members locked me out, and came with shotguns to the church steps and said they were tired of ministers, that they had had four, and would not have a fifth minister. By dint of eloquence and superior education I obtained their consent to enter the church. Well, I tried faithfully to attract them. I never had more than a handful, and for six months all seemed dead set against me. I could not draw. Completely discouraged, I was in my study praying when the door opened and a little conjure man came in and said softly: 'You don't understand de people. You must get you a hand as a friend to draw 'em. Ef you will let me fix you a luck charm you'll git 'em.' In my desperation, I told him to fix it. He brought the charm back in a few days, and said, 'Now, you must feed it wid alcohol, whisky, or spirits, and never let it git dry, and always wear it nex' your heart when you enters or leaves de church.'

"It was only an ugly piece of red flannel, and I hate to confess it, but I obeyed his instructions. I always felt for it before I went down on my knees to pray. The next Sunday the church was full of people. The following Sabbath there was not standing room. For four years the aisles were crowded every Sunday. I knew it was not the gospel's power, but that wretched 'luck ball.' When the bishop sent me to another church he wrote and said: 'When you came they tried to drive you away with shotguns; here, now, twenty men write me begging to have you stay. Now you draw beyond any minister in the city! How is this?' I was ashamed to tell him. I opened the charm, and found these things in it. It was a large piece of red flannel, with a horseshoe magnet fastened flat to it. In the center of the space in the magnet was a bright silver dime. On one side were sewed two needles, on the other side of the money one needle. Below it were two more needles. The whole was covered with what looked and tasted like gunpowder. I tore it up and threw it away, and have never been able to draw an audience since.—You want one? Well, I'll try to get one for you."

"Indeed I want one! What lecturer would not?"

I give this as an instance of the peculiar persistency of African ideas even in enlightened, civilized, Christian minds.

There is a Mrs. R—— in a side street in a Northern town whom I lately visited. She was the most prominent member in the Baptist colored church. She was the leading singer. Another singer got jealous of her power to holler the loudest; besides, she wanted to get her washing away from her as well as her husband, and, worst of all, *conjured* her. At last the first singer fell sick, and the doctor could do nothing to relieve her. A conjure woman called, and for twenty-five dollars undertook the case. She came in and moaned a few incantations in an unknown tongue. She carried a satchel, and took from it a glass, poured some gin into it and drank a little, and then, holding her hand over it, said:

"Mrs. R——, look inside yourself and tell me what you see."

Mrs. R—— was hypnotized, I suppose, and said, "I see pizen, and snakes a-crawlin'."

"That's right! It's the lady across the way has put the spell on you, and she has cut your shape out in red flannel and stuck it full of pins and needles and biled it. She's trickin' you, and killin' you. But I'll throw it back on her—scatter your spell to the four winds. She has killed a snake and taken the blood and mixed it with wine, and in twenty-four hours it turned into snakes and you drank it and you were going crazy, and your home would have been gone." It is needless to say the sick woman recovered.

She showed the caul she was born with tied up in a bundle in her stocking. The neighbors were always trying to touch the lump so they could put spells on people and be healed from diseases. The conjure woman also makes luck balls for sale. She tells her customers they must always wear them next their skin on the right side, and keep them wet with "feedin' medicine."

I was so fortunate as to discover the contents of one of her balls. Corn, twine, pepper, a piece of hair from under a black cat's foot, a piece of rabbit's right foot, and whisky—all put into a red flannel bag. This was all inclosed in a buckeye biscuit. She puts loadstones in some of them to draw away a lover from a girl. She also takes roots of several different herbs and flowers and makes them into love powders, and gives them to a darkey lassie to throw upon her truant lover to bring him back to her waiting heart.

It is not to be disputed that Africa has touched in many ways and in divers places the highest civilization of the Old World. I am fully persuaded that in the near future scientific researches will discover among native African tribes traditions which disclose the real parentage of many of the weird stories concerning the

Creation and the Flood which are now current among their descendants in this country. The same may be said of "Brer Rabbit" and the "Tar baby," "Brer Fox," "Brer Dog," "Brer Wolf," and all that other wonderful fraternization with animal nature which simple savage life and unbridled childish imagination suggest. In many instances they will be found absolutely identical with those that are now told in the wilds of Africa.

To show the existence of this belief among the negroes themselves, I will quote from an old negress, whom I know well, named "Aunt Lucinda":

"Dis is an ole tale. Hit done come down since de Flood. Why, chile, de Bible didn't git eberyting by a good deal—cose it didn't! Us niggers done tole dis in Africk, and Moss John done say de Bible say ef it got all de words Jesus say hit couldn't holt 'em. And dere's lots of tales de Bible didn't git. Dis one now be 'bout de hammer and de ark:

"One time God done tole Moss Nora to build him a ark, case de people fo de Flood was a singin' and a cuttin' up and a givin' entertainments, and God wanted to raise up a better people to a sarve him, and so Moss Nora had to build de ark tight, so de few people wouldn't drown. God tole him to take a he and a she of every kind and fix de jistes tight so de ark wouldn't leak water when de Flood came. De people sat around on de benches a-pokin' fun at him, and dey say, 'Moss Nora, what you doin'?'

"He say, 'I's a-hammerin' de jistes tight.'

"And de people say, 'What dat you doin'?'

"And Moss Nora say, 'I got this ark to build, and I gwine to build it.'

"And de people kep' a-pokin' fun. Dey say, 'Moss Nora, what dat hammer say?'

"And he say, 'What it sound to you like it say, humph?'

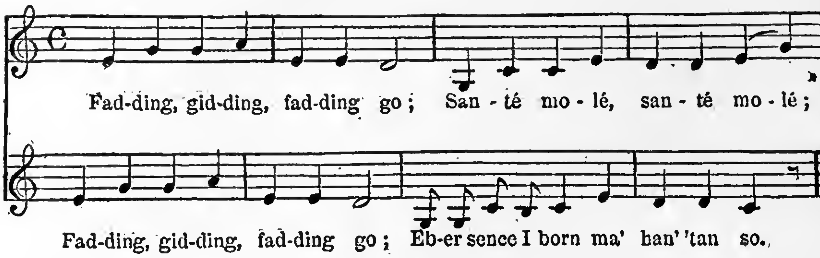
"And de people laugh and say it soun' like it say nuffin but 'Tim—tam! tim—tam!'

"And Moss Nora say: 'Dot's whar you fotch up wrong. I got ter build this ark so tight de water won't leak thoo, and de people won't fall out, and dat hammer don't say "Tim—tam," no sich ting. Hit say ebery time I hits de jistes, "Repent! repent!"'

"Dere's a spiritual what goes long wid it too, honey, 'bout de hammer an' de nails, but I don't know it. Hit's a ole, ole story dat we been singin' since de Flood—jes come down from mouf to mouf. Hist de Window is a ole tune, but not ole like dis one. Hit done come jis like I tole you."

In regard to one song, at least, I have irrefragable proof of its African origin. Mrs. Jefferson Davis tells me her old nurse was a full-blooded African named Aunt Dinah. She would lovingly put her little charge to sleep with this doggerel:

FADDING, GIDDING.



Aunt Dinah would also sing it pleadingly when begging for a present. She would begin the supplication with hands clinched tight, and open them quickly at the last line. She declared that she always sang it in this exact manner in her old African home whenever she was asking a favor, but she was never able to tell the meaning of any part of it except the last line, the African of which she had forgotten, but which meant that all black races are born with wide-open palms ready and waiting for other peoples to pour rich gifts into them. This she translated in her apt, crude way: "Eber sence I born, my hand stand so!"

She had a relative named Moses, I think, who had three deep gashes radiating from each eye. Of these he was very proud, as he said they indicated that he was of the king's blood.

Ten days have elapsed since the above was written. I feel like crying, "Eureka!" I have found my proof! After a diligent search for a real live African, I have found an educated convert to Christianity, who has been absent only two years from the wilds of the west coast of Africa. In broken English he sang for me several songs sung by the savages of the native Mendi tribe. The tunes sounded much like songs I know, but I could not take them down during this interview. All the songs I sang he said seemed very familiar—in certain portions especially so.

I was especially interested in the description he gave of a peculiar ceremony common among the wildest Bushmen and the Yolloff tribe. My informant grew up and played with them a great deal when a child. He says the death of a young boy they consider an affront to the living—an affront which they never forgive. It is singular that among some of our Indian tribes a similar notion prevails. The friends meet around the corpse and exclaim, while they chant and sing and dance, in a high-pitched voice: "Why did you die? Were you too proud to stay with us? You thought yourself too good to stay with us. To whom do you leave all your things? We don't want them! Take them with you if you are so stuck up; we'll bury them with you!"

They work themselves into a perfect fury, and one gets a whip and flogs the corpse until it is horribly mutilated. Then the few who have really been friends to the child in their crude way draw near and begin to sing:

"Anasa yi.
Anasa papa,"

which this native African assured me meant, as nearly as he could translate it—

"Find out how mother is.
Find out how papa is."

The curious identity of the name for father in this African dialect and our own he could not explain.

Even while the relatives were thus speaking kindly to the departed child, others would come up with whips, and with blows spitefully exclaim: "Tell my father's sister I am happy. Speak to her for me." This they said, mocking the relatives for sending messages.

What better proof is required of the origin of the peculiar custom of the negroes in our own Southland of sending communications by the dead? He also gave me new stories of Brother Conch, and a tale of a rabbit and a pitch-man.

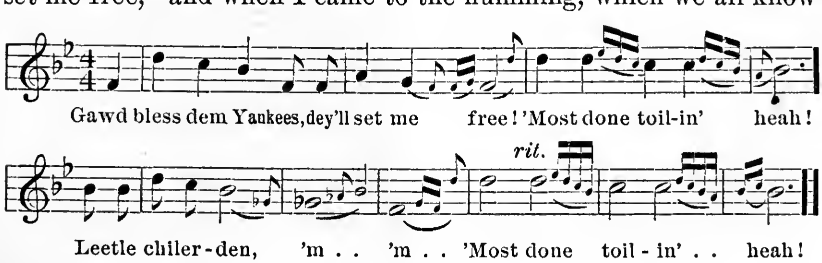
He says he has heard a savage tribe often sing to the beat of a peculiar drum, as they started to pillage and destroy a neighboring tribe, these words, which he could not translate:

"Zo, whine, whine,
Zo, bottom balleh.
Zo, whine, whine,
Zo, bottom balleh."

Some of the tribes are followers of Mohammed. After they have broken their fast, they sing this hymn to their God:

"Li li, e li li,
Moo moo dooroo, soo moo li."

I then sang for him a part of "Gawd bless dem Yankees, dey'll set me free," and when I came to the humming, which we all know



is the marked peculiarity of the negro singing, he stopped me and said, "Whenever you hum that way it means 'Hush!' and among the tribes I have known it always comes in baby songs." He then sang this one, which a heathen woman used to sing to his little sister "Amber":

"Amber in a wa,
Keen yah feenyah ma,
Amber in a bamboo carri,
Amber eeka walloo.
Um, um, um."

A rough translation of this means: "Amber, be quiet and I'll give you something. I'm not going to flog you. You are quiet, so I thank you. Hush, hush, hush!"

REMEDIES FOR THE DEPOPULATION OF FRANCE.

By M. JACQUES BERTILLON.

FRANCE is on the way to become a country of the third rank. It is perishing for lack of births. Its population remains stationary, while that of all the other great countries has largely increased since the beginning of the century. This points ultimately to a certain growing inferiority in military strength, economical prosperity, literary prestige, and scientific repute; and finally to a progressive diminution of French influence upon the march of civilization. This depreciation of France comes partly from political causes and partly from its low birth rate.

In the examination of the remedies which have been proposed to antagonize this evil, we shall begin with a rapid review of those which appear to be least efficacious. Then we shall present those which figure on the programme of the *Alliance Nationale pour l'accroissement de la population française*, a society which should include all French people who care for the future of their country.

The reforms for which the depopulation of France has served as the vaulting board may be divided, notwithstanding the great variety of them, into four categories: (1) Various social reforms; (2) increase in the number of marriages; (3) diminution of involuntary sterility; and (4) reduction of mortality.

We have a word to say with respect to each of these:

I. Social Reforms proposed for the Hypothetical Purpose of increasing Natality.—Nobody has ever shown that the emancipation of woman, selection in paternity, the suppression of divorce, or, the contrary, laws facilitating divorce, would augment natality. Nobody has ever given a proof, or the beginning of a proof, in support of these fancies.

Would socialistic reforms leading to a diminution of the share of capital, and a corresponding increase of the share of labor, have any effect upon natality? I can not pronounce upon this question, because I have not sufficient data; nevertheless, the remuneration of capital has not ceased to diminish since the beginning of the century—we may even estimate that it has diminished nearly one half, for the nominal interest on money has fallen from five to three per cent. This has not prevented natality from decreasing in our country. Would it be augmented if capital should come to have no remuneration at all? I have not examined this difficult and very hypothetical question, for, if such a thing should happen, it could be only in an extremely remote future. But the supreme struggle of which our country has always to think will have taken place long before that.

The revival of religious ideas, if it should come about, might have some effect on natality. Demographic studies have shown how great an influence religion has on habits and on phenomena of moral pathology (on the frequency of suicides, for example), and prove that men put the prescriptions of their religion into practice more than one would believe. All religions direct man, more or less imperatively, to have as numerous a posterity as possible. There may therefore exist a relation between natality and the degree of sincerity of religious convictions. But it is manifest that, whatever we may do, we can not change our age nor prevent its growing more and more incredulous.

II. Summary Examination of Measures having in View the Increase of the Number of Marriages.—Nuptiality is nearly the same in France as it has been. It has, however, diminished during the last twenty years, falling gradually from eight marriages to seven marriages a year per thousand inhabitants. For seven years past it has gained a little, and is now 7.6—a fairly satisfactory rate. It is not here that the saddle galls us.

It has been proposed, as a measure for increasing the number of marriages, to simplify the required formulas. I believe that these formulas are indeed too long, too many, and too expensive. The countries which have been so foolish as to copy our civil code have taken pains to strike out this chapter, and they have done well. But he is greatly mistaken who believes that the number of marriages could be perceptibly increased by suppressing unpleasant formulas. When one wants to marry, he generally does so in spite of the obstacles which maladroit legislation may have piled up. In case of need, the matter is settled by an irregular affiance, and natality loses little.

The violent suppression of convents has also been proposed as a measure for promoting the increase of marriages. A person who has reflected much could not speak of such a thing. To what extent does any one suppose that might augment natality? The convents at this time contain about sixty thousand women. Suppose they were all as ready as other women to marry—which is not the case, for the fact that they have retired to a cloister proves that family life has few attractions for them—a simple calculation shows that they would afford forty-five hundred births a year. So France needs six hundred thousand infants every year, and a plan is advanced to give it four or five thousand at most—and that by means of a violent measure, unworthy of an age of freedom!

Next are the *measures proposed for diminishing involuntary sterility*. Is involuntary sterility as frequent as it is supposed to be? Our respected master, Jules Rochard, was surprised to find two million sterile families recorded in the census reports. But the number does not appear excessive. We can not compare it with similar returns abroad, for France is the only country, except in the case of a few cities abroad, in which items of this kind are inquired into by the census takers. But, according to different gynæcologists—chiefly German—cited in the Academy of Medicine, the number of sterile families should be sixteen per cent. Now, this is the exact proportion found in France in the enumeration of 1896. The really surprising thing about the matter is not the number of sterile families, but the limited fecundity of the fertile families. There are other figures to show that absolute sterility is not the cause of the low rate of French natality. An inquiry respecting sterile families was made in 1856, at a time when French natality was a little higher than it is now, a comparison of the results of which with those of the enumeration of 1886 shows that the number of fruitful families had not diminished (83.6 per cent of the families having one or more children then, to 83.3 in 1886). The factor that has diminished is the fertility of the families. It is only necessary to cite the measures that have been suggested to counteract this supposed excessive sterility to make their inanity apparent. Among them are reform of the abuse of tobacco and alcohol and war upon syphilis. Do not these scourges exist among other nations than us? Nothing could be more salutary than to war upon them, but to connect their existence with the depopulation of France is a singular exaggeration of their importance. More than this, the physician of a benevolent institution in Paris has told me that the large families who resort to his dispensary nearly all have a drunkard at their head. The families that issue from such parents are not necessarily degenerate. This curious observation ought not certainly to make us partisans of drunkenness, but it demonstrates to us that the suppression of alcoholism is not what will restore French natality. Rather the contrary.

III. Examination of Measures proposed for diminishing Mortality.—As the question of the population of France has been more especially discussed by the doctors, it has done great service as a vaulting board for medical theories. Doctors are very ready to reason as if they could dispose of human life at their will. It is very hard to keep a man from dying. The most skillful doctors have not reached that point; but it is very easy to have a man born, and is within the reach of the latest-made young practitioner. It is very doubtful whether the proposed measures will be efficacious or practical. See how much trouble we have had, after a century of experiments, in realizing the benefit of vaccination, the only nearly infallible remedy we have against disease. Surely a country ought to guard itself as much as possible against sickness and death, and should do everything that will conduce to that end, as we do all that is possible to cure a man ill with pneumonia or any other disease. But we should not delude ourselves with illusions, and we have to confess that the efficacy of the measures which we take to satisfy our conscience is very doubtful. The failures of hygiene are almost as numerous as those of medicine.

Mortality has not increased in France. It is rather less there than in other countries in the same latitude, and even less than that of some of the countries situated farther north. So we can hardly hope to diminish it very much.

The effect of mortality on the whole is, moreover, not to diminish natality, but rather to favor it. The death of an adult leaves some position vacant, and makes room for the institution of a new household and the birth of other children. So when a rich old man dies, the money he leaves helps set up his children in life; and when a poor old man dies, a burden is taken away from his descendants, who had to support him and who can now marry and have children. Some of the parallelisms in the movements of population which statisticians have observed may be explained thus. We might compare a human society to a tank so arranged as to be always full of water. It has a supply pipe (natality and immigration) which opens and operates only when the discharge pipe (mortality and emigration) is also open; or to a forest of definite extent, in which, when a clearing is opened, a new growth appears in the cleared space, unless some cause exists to prevent it, which cause it will be the forester's business to find and remove. He would not think, however, of stopping the cutting of the old trees, for that would be to prevent the essential condition of the new growth's getting a headway. The law of all living societies, in forests and in nations, is the perpetual renewal of the stock.

IV. Of Measures that will be Effective.—The evil must be fought in its causes. These causes are detestable family customs, dictated by pecuniary considerations. These being the things to be reformed, and money being the cause of them, the beginning should be made with money. We have a right to demand energetic measures, severe if necessary, against the evil that is eating France. Those which we shall ask for here are only equitable. They shall fully respect individual liberty, and in some cases augment it. Their purpose is to teach the French people who do not know it the immense wrong which their mistaken selfishness is inflicting upon the country. They aim especially to modify customs, and to invoke for reasonably numerous families the profound respect and protection that are due them. And they seek to harmonize general with particular interests, a thing to which the present laws have precisely the contrary effect.

It is just as much every man's duty to contribute to the perpetuity of his country as it is to defend it. This is a moral truth which the French have forgotten, and it will have to be inculcated in them. The case is beyond the reach of the most eloquent sermons, and will have to be met, if the mass of men are to be convinced, by palpable facts that will touch all personally. This leads to the principle, which seems, moreover, self-evident, that the fact of bringing up a child should be considered a form of tax payment. The payment of a tax is, in fact, the imposition of a pecuniary sacrifice for the profit of the whole nation. This is what the father accepts who rears a child.

A family, to be acquitted of the tax, should rear at least three children. It takes two children to fill the place of the parents, and there should be a third in addition, for one in three families, on an average, will have no children. Hence the family which does not rear three children will fail of imposing sufficient sacrifices upon itself for the future of the nation. It is free to do this, but should pay damages for it. He, on the other hand, who rears more than three children imposes supplementary burdens upon himself, for which he should be recompensed every time occasion offers. The principle of a reduction of taxes proportioned to the number of children was applied in June, 1898, at the instance of the *Alliance Nationale*, by the city of Lyons. It has been adopted, very timidly at first, and then a little more broadly, by the Minister of Finance.* But it would be easy, and even necessary, to go considerably further in this direction.

To accomplish this reduction without the treasury losing anything, it is only necessary to charge the less prolific families with one fifth additional tax. The demographic condition of France is, in fact, so deplorable that families of more than three children form only one sixth part of the whole number, or are 2,122,210 out of 12,127,023; hence, in order to clear fully from liability for taxes these two million families, it is enough to charge the other ten million families with supplementary taxes of twenty per cent—a thing that is entirely practicable. It may, however, seem more expedient to scale the supplementary impost, so that it shall fall in inverse proportion to the number of children. Thus, let bachelors more than thirty years old pay fifty per cent; households without children, forty per cent; families with one child, thirty per cent; families with two children, ten per cent; families with three children, the present tax without addition; while families with more than three children should be wholly exempt. A simple calculation will show that the treasury would gain by such an adjustment. It would lose 2,122,210 contributors of taxes, and would gain, against these, 2,456,112. Furthermore, families with more than four children are usually poor and hardly able to pay even light assessments, while those we propose to tax supplementarily are mostly wealthy, whence the tax against them would be generally productive.

These scalings and exemptions might be applied to all the various kinds of direct taxes, so that the state should say, in effect, to the infertile families: "You have done a wrong to your country. We have no thought of punishing you for it, but it is not right that you profit by it. You must pay damages for it."

The plan actually followed by the state, instead of making lighter the meritorious burden which the head of a numerous family assumes, does everything to make it harder. All the direct and indirect taxes seem to fall higher upon families having many children. It would not be exact to say that the law is indifferent to natality. It would be more just to say that it does all it can to discourage it, and that every Frenchman is officially invited, in his own interest and that of his posterity, to limit it as much as possible. The contrary is what should be done.

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* France is not the first country that has started on this course. The spirit of justice has suggested similar reforms in countries which have no questions of depopulation to deal with. Reductions of taxes proportioned to the number of children have been granted in Prussia, Saxony, most of the secondary states of Germany, Servia, Norway, Sweden, several Swiss cantons, and Austria.

There are wealthy families which are in a position to contribute most liberally to the perpetuity of the nation, and yet, strangely, they are the most abstemious. It would not be fair to tax them according to the number of servants they have, for this must increase as children multiply; but the tax might be adjusted to the excess of servants over children.

As an objection to our plan, it may be asked if we really believe that those "neo-Malthusian" families who have only one or two children will decide to have four in order to save themselves from some taxes? We do not cherish this illusion; but the sordidness of the family customs of the country should not be exaggerated. Most of the families sin through selfishness, while they do not realize that their selfishness is culpable, harmful, and ignoble. This must be made clear to them, and no method of publishing the fact is as imposing and effective as the tax-collector's schedule. The reform in direct taxes which we propose will therefore have an educational influence.

The same principle might be applied in the military service by expediting the discharge of soldiers who are married. A bill to this effect has been introduced in the French Senate, and an amendment has been proposed extending the favor to the eldest son of a family of five children.

The inheritance tax is a particularly fitting form of impost in which insufficiently fruitful families might pay the indemnity which they justly owe the state on account of their sterility; for the prime object of the neo-Malthusians is to forestall the necessity of dividing their fortunes among too many children. The laws of succession are so framed now that *only* sons pay less than others; not only are the expenses of notarial acts less for them than for families with several children, but the latter are liable to pay the tax several times, for when one of the heirs dies his brothers and sisters will have to pay new succession taxes. In all cases of this order the treasury burdens numerous families, and spares neo-Malthusian ones. The institution of heritage stimulates industry, and is one of the chief reasons for it. A great many men, we are sure, would work less and would certainly save less except for the prospect of leaving the fruit of their labor and economy to their children—or, too often, to their only child. But as the institution of heritage becomes under these conditions one of the prime factors of depopulation, it will have to be modified.

The state is as much interested in the fecundity of families as it is in their industry and thrift. To stimulate the latter virtues it guarantees them the right of inheritance. It might withdraw it or diminish it to its own profit, if their fertility was not judged sufficient for it. For such a measure to be effective its application should be severe enough to touch sensibly the fortunes of families which have given the country only one or two children. The state, for instance, might reserve to itself the disposable part of the inheritance—half, for instance, in the case of families having only one child; a third, of families where there are two children; and waiver of the extra tax where there are three children. The principle might be approximately expressed as that of treating single children as to their inheritance portions as if they had brothers. But as a proposition so worded would have but little chance of immediate adoption, we should have to be satisfied with a less radical reform. If it is objected that such measures would be too revolutionary and too much opposed to existing ideas and habits, the answer is that anodynes would be without effect upon so profound and inveterate an evil. French families must cease to have an evident interest in limiting the number of their children, and something more than half measures will be needed to achieve such a result.

Our principle is equality of burdens. We say to the French: "You have three chief duties toward your country: to contribute to its perpetuity, to its defense, and to its pecuniary burdens. We affirm that you have failed in the first of these duties. This being true, you must accept the other two with a supplement. With this principle severely applied, and with some other reforms, we hope to bring back to the country the idea of the respect that is due to numerous families and of aversion against the detestable habits that are destroying France."

The sums derived from the increased succession taxes which we have proposed to assess upon families that have given the country only one or two children might be reserved for the education of poor children or for the realization of some such plan as has been proposed by M. Raoul de la Grasserie for the pensioning of a retreat in old age for the parents of large families.

Another means of encouraging parentage may be found in instituting special honors and marks of esteem for the fathers and mothers of numerous children. Thus the General Council of the Drôme gives a gold medal on the 14th of July to each of the two women in the department who excel in this respect. A fund has been created at Nantes for providing rewards to those who have the most children under fifteen years of age. A system of rewards also exists at Meaux for those who have contributed most to the population.

The French law requiring the equal division of estates among all the children operates as a deterrent to parentage. A father who has built up a large business or accumulated a handsome domain is exceedingly averse to the prospect of having it cut up and dispersed, and is therefore careful to have but one child, so that it may descend unimpaired to him. The coincidence that France is the only country where this system prevails, and is, at the same time, the only one where the population is decreasing, is striking enough to suggest a connection between the two phenomena. The law works mischievously in this respect, and requires modification in the direction of giving the parent larger privileges of testamentary disposition.

Thus, the state should in every way and in every department of law and administration manifest its profound respect for large families; it should set the example on this point, for it is the party most largely interested.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

WEST INDIAN POISONOUS FISHES.

By JAMES MACDONALD ROGERS, F. R. C. S.,
STAFF SURGEON, R. N.

AT a time when so much attention is being paid to the West Indian Islands as regards their politics, social condition, and natural history it may not be out of place to briefly consider the subject of the poisonous fishes to be found in the neighboring seas. Considering the number of unwholesome fish abounding in these waters and the numerous cases of illness caused by them, I was surprised on investigation to find that so little appeared to be known or written on the subject. During my three-years' cruise in the West Indies the study of those fishes reputed to be poisonous was forced upon me by reason of the numerous cases of illness among the sailors of my own ship. When it is asserted that there are no less than sixty varieties of noxious fishes to be found in Cuban waters alone, it seems desirable that those who are about to settle in these parts should have some general idea as to what fish to choose and what to avoid.

Colored fishermen are not too particular about hawking unwholesome fish in the streets, even when its sale is forbidden in the market, and numerous cases have come under my notice where the unwary purchaser has paid the penalty by a sharp and painful illness. One of the great delights of our sailors is to land on some sandy beach, provided with a large seining net, in order to catch fish, the consumption of which varies the monotony of salt beef and pork. On examining the hauls they made I invariably found some unwholesome specimens, which I advised them to reject, and by so doing every time they went seining had no more cases of fish poisoning on board.

In tropical seas some fish are found to be always poisonous wherever and whenever caught, but there are numerous instances where wholesome fish become noxious when found in certain localities, especially on coral reefs and shoals. Fish when feeding on decomposing coral polyps, medusæ, and poisonous mollusks found on these reefs often become noxious, as the following instance will prove: Midway between Cuba, Hayti, and Jamaica lie the extensive reefs and shoals of the Formigas, which are several miles in extent and covered by a small depth of water. These shoals present a concentration of all the incidents to be found in West Indian fringing shore reefs. Arborescent corals and spreading millepores stretch on walls and ledges, interspersed with huge meandrinas and brainstones, among which lodge a profusion of *Holothurias*, starfishes, and a variety of sponges. This great mass of reefs, called from their clustering swarm the Ants' Nest, or the Formigas, abound with all sorts of fishes. As you approach the great submarine plateau, the odor of the slime and of the spermatic substances that find a resting place in the crevices and shallow pools spread through it is very remarkable—the pleasant blandness of the sea breeze suddenly changing to the nauseating smell of a fish market. Those who have waded on tropical shore reefs know not only the strong scent given out by the polyps that build there, but feel how sensibly the hands are affected, and how the skin of the thighs is susceptible of a stinging irritation from the slightest contact with the slime of corals. It has been found by invariable experience that all the fishes taken on the Formigas are pernicious; that the barracudas especially are always poisonous. Similar stretches of shoals among the Bahamas produce fishes deleterious as food.

The low-spreading ledges and banks of the Virgin Islands, called the Anegadas, or the Drowned Islands, afford a similar unfavorable ground for fishing. In this way we may account for the remark of Dr. Grainger that fishes are poisonous at one end of St. Christopher while they are harmless at another. We get over, by these several incidents of those fishing grounds, the adventitious occurrence of poisonous among wholesome fishes, which become deleterious from the food on which they subsist at certain seasons on certain banks and coasts.

Again, in the tropics wholesome fish soon become virulently poisonous if kept too long, as the fierce heat favors rapid decomposition. In this short article I have only space for a description of the most common and injurious fishes met with in the West

Indies. One of the commonest fish in these seas is the barracuda (*Sphyræna barracuda*), which can be easily recognized by its elongated body, covered with cycloid scales. The color is dark olive-green on the back, fading to a lighter green on the sides, while its under surface is silvery white. The mouth is wide and curved, with long and sharp teeth. These fishes are large and voracious, often attaining the length of six feet; and as they are usually found close inshore, amid the heaviest surf, they are as much feared by fishermen and bathers as the shark. Indeed, they are more to be feared, for the shark as a rule is timid, and unless extremely hungry is cautious in its voracity. The barracuda, on the contrary, is very bold. The shark flees from a splashing in the water, but the barracuda goes there to see what he may find, as he is only attracted by live bait. The wounds inflicted by the barracuda are exceedingly severe and sometimes fatal.

When young this fish is generally used as food, but having attained a certain size the flesh becomes exceedingly noxious, at least at certain seasons of the year. This change is said to be due to the poisonous fish on which they feed. When caught on certain banks, as the Formigas, their flesh is always extremely unwholesome, and, as Kingsley says, they have this advantage, that while they can always eat you, you can not often eat them with impunity. The Cubans, as a rule, will not touch this fish, and at Santa Cruz it is the custom never to eat it till the next day, and then not till after salting it; but that is apparently no safeguard, as four persons living in Kingston, Jamaica, suffered severely after eating "corned barracuda."

It is stated that when unwholesome, its teeth will be found of a blackened color at the base, and on inserting a silver coin into its flesh this will also turn black. The poisonous symptoms caused by this fish are peculiar, and were strongly marked in the case of a friend of mine who was a solicitor living in Barbados. He and several others who had partaken of the same fish suffered from severe gastro-intestinal disorder, with intense nausea and vomiting. His face swelled up and became tubercular like a leper; afterward, general muscular tremblings and acute pain about the body, particularly in the joints of his hands and arms, came on. The nails of his feet and hands became black and fell off without any pain, and his hair also fell out. For years after he suffered from debility and tubercular skin eruptions. Death sometimes follows, but those who do not die suffer for a long time from its effects, which in some cases last for twenty-five years.

The "yellow-tailed sprat" (*Clupea thrissa*) is common in the West Indies, and may be recognized by having its last dorsal ray prolonged into a filament. A black spot behind the gill cover is said to distinguish it from a somewhat similar fish, the "red-eared pilchard," which has a yellow spot behind its gill cover. Schomburgk gives testimony to the poisonous properties of the "yellow-tailed sprat" when found at certain periods of the year among the Leeward and Virgin Islands.

The eating of this poisonous "sprat" is said to be followed by most violent symptoms and rapid death. The common saying in the West Indies—that if you begin at the head you never have time to finish the tail—is almost literally true.

The eating of the roe of this "sprat" caused in Japan, in the year 1884, twenty-three deaths. The victims suffered from severe inflammation of the mouth and throat, strong abdominal pain, formication in the arms and legs, disorders of vision, paralysis, convulsions, and loss of consciousness. Nausea, vomiting, and diarrhœa often occurred. Death followed in some cases in a quarter of an hour, but mostly in from two to three hours.

Lacroix describes a case of poisoning through eating the "sprat" which occurred on board a French man-of-war. Out of a crew of fifty men, thirty were dangerously ill and five died. The men experienced strong muscular cramps in the arms and legs, nausea, vomiting, and diarrhœa. Afterward congestion of the brain, delirium, and coma supervened.

Most of the cases of fish poisoning which I have met with in the West Indies have been due to eating various kinds of "snappers," especially the "gray snapper." The tropical species are very numerous and difficult to differentiate, owing to their frequent change of color according to age and surroundings. In 1897, at St. Georges, Grenada, twelve persons who partook of a large gray snapper were attacked with severe symptoms of fish poisoning. A few hours after the meal all these were suffering from pain and fullness in the stomach, followed by persistent vomiting, severe cramps, watery evacuations, weak, thready pulse, and labored respirations. One of the victims was examined by me four months afterward, and he stated that, owing to intense weakness, he had been forced to keep his bed for several months, during which period he suffered from various nervous disorders. He had shooting pains and tingling of the limbs, dimness of vision, and quick, thready pulse.

In 1893 seventeen persons living in Bridgetown, Barbados, were attacked by similar symptoms to those mentioned above. All these had eaten of a fish which had been hawked about by a fisherman, and which was subsequently identified as a "gray snapper," though sold under a more innocent name.

A Spanish naval surgeon, Don Anton Jurado, while serving on board the gunboat Magallanes had an opportunity of proving Poey's statement that the fishes caught on the coast of Cuba are often very poisonous. No less than twenty-seven of the officers and men were taken ill, most of them with gastro-intestinal disturbance of a more or less severe nature; the others suffered from nervous symptoms.

The horse mackerel, green cavalla, and the jack are often found most unwholesome when caught in West Indian waters.

In Barbados a whole family were seized with symptoms simulating cholera from eating "green cavalla."

The editor of The Barbadian writes: "We think it right to caution people against the fish called 'green cavalla' from being purchased by their cooks. Some years ago we know that several individuals were extremely ill from eating this fish, which is frequently very poisonous. The night before last a whole family in Bridgetown, except the master, who fortunately had dined out, were seized with violent cholera after having partaken of cavalla."

The "jack" (*Caran plumieri*) is found to be poisonous in some seasons of the year, and it is said that at such times two small red lumps appear in its gills. When they are suspected of being in a poisonous condition an experiment is tried upon a duck by giving her one of them to swallow, and if at that season it is poisonous the duck dies in about two hours. The "rock hind," or "smoky hind," after attaining a certain size becomes most unwholesome, and often infested with parasites. Numerous instances of severe symptoms attacking persons after eating this fish are recorded.

Toadfish, or *Tetrodons*, are occasionally met with, and are to be avoided as being extremely poisonous, especially if the roe or liver be eaten. A family of coolies in Trinidad, in spite of being warned, ate one of these fishes, with a fatal result. The symptoms were blunted sensibility, trembling, general muscular weakness, difficulty of breathing, vomiting of blood, convulsions, and death.

The *Diodonts*, "trunkfishes," are not nearly so poisonous as the *Tetrodonts*, but they are found to be very noxious at certain times or in certain localities, more especially if the gall bladder, liver, and intestines are not removed before cooking. It is reported that those persons who had eaten them suffered from loss of sensibility, cold sweat over the whole body, and stiffened limbs. Death followed in some cases.

The "prickly bottle fish" (*Diodon orbicularis*), met with in the Gulf of Mexico, is said to be injurious when eaten.

The *Ostracion triqueter*, called in the West Indies "fair maid," "plate fish," "trunkfish," is often eaten with no ill effects by the negroes, who, after cleaning it, bake it in its hard shell-like covering. There is, however, a gelatinous matter near the tail which is called "the jelly," and a similar substance is found near the head. When only part of this jelly has been eaten its effects are a peculiar vertigo, nausea, vomiting, pains all over the body, more especially in the limbs. The feeling of vertigo is similar to that of intoxication, hence the fish has been called "drunken fish."

The "filefishes," or "trigger fishes," when found in the tropics, where they feed on coral polypi, have the reputation of being most unwholesome.

In the West Indies "sea eels," or murenas, are only eaten by the negroes. The blood of eels is said by Mosso to contain a poison like that of vipers. It is related that a man drank some eel's blood mixed with wine, and was in consequence seized with severe diarrhœa, disturbance of vision, foaming at the mouth, and stertorous breathing. He ultimately recovered after vigorous treatment.

Dr. Gordon, of Montego Bay, Jamaica, records a case of death from eating the flesh and liver of a species of coast conger (*Gymnothorax restratus*). In spite of treatment, the man died after a lingering illness.

Space will not permit me to dwell in this article on the remaining noxious fishes, but it is to be hoped that enough has been written to teach people to be cautious in their selection of fish when in the West Indies.

THE COLORS OF NORTHERN FLOWERS.

By JOHN H. LOVELL.

FOR profusion of bloom and brilliancy of coloring, the land of the tropics, with all its luxuriance of vegetation, can offer nothing to compare with a New England meadow in June. Along the great rivers of the South or in the islands of the East strange and beautiful flowers occur individually or in small groups, but the traveler looks in vain for myriads of blossoms giving a distinctive coloring to the landscape itself. It was long the popular notion that the colors of flowers were of no importance except as they gave human pleasure. This idea has been made familiar by a well-known line of Gray's Elegy. It was a German pastor, Christian Conrad Sprengel, at the close of the last century, who first pointed out their true significance. So enthusiastically did he pursue his botanical studies that he neglected the duties of his office, and finally even omitted the Sunday sermon. The natural result followed, that he was deprived of his parish. In straitened circumstances he then sought unsuccessfully to maintain himself at Berlin by giving lessons in botany and Sunday excursions in search of plants.

His book, now a botanical classic, attracted but little attention; his publisher did not even send him a copy of it, and in disgust he turned from the study of plants to that of languages. The title of the work, The Secret of Nature in the Form and Fertilization of Flowers Discovered, affords us the pleasure of knowing that he rightly estimated the importance of his observations. Sprengel clearly states that the bright hues of flowers, as is now well established, serve as signals to attract the attention of nectar-loving insects flying near by. He was led to this conclusion very fitly by the study of *Myosotis*, the "forget-me-not." He has not been forgotten. His name and theory were rescued from obscurity by Darwin; his book a few years ago was reprinted at Leipsic, and is now universally recognized, says H. Müller, as having "struck out a new path in botanical science."

A day's stroll through the fields and woodlands is sufficient to show that yellow and white blossoms are in Nature more common than red or blue. From an examination of 741 New England and Eastern species belonging to 48 families (see table) it appears that 164 are yellow, 283 white, 71 red, 136 blue and purple, and 87 green. Greenish flowers occur in 25 families, yellow in 29, white in 32, red in 16, purple and blue in 22.

Yellow appears to have been the first color developed, and flowers with this coloration are usually simple and regular in structure, as the buttercups and five-fingers. But why, it will be asked, should yellow have been the primitive color? The spores and spore-cases of the club mosses, and the pollen of all cone-bearing trees, and, in fact, of most plants, are yellow, and the yellow coloration of the first petals is doubtless correlated with this fact. Flowers of this tint are peculiarly attractive to yellow-banded flies, and when dull are avoided by beetles. Yellow flowers vary greatly in size, but pale yellow flowers are usually small, and bright or orange-yellow are large. *Ranunculus abortivus* and *R. sceleratus*, which grow in wet places, are small and pale, while *R. bulbosus* and *R. acris*, the familiar buttercups of our meadows, are an inch broad. An apparent exception to the above rule is offered by the globe-flower (*Trollius laxus*), found in dense swamps, which has solitary, very large, pale greenish-yellow flowers. As the cultivated European and Asiatic species have bright yellow flowers, the coloring of the sepals of *T. laxus*, for the petals are wanting, has probably retrograded from growing in dense shade.

Yellow flowers in their natural state exhibit but little variation of color. They change most readily to white, and less often to red or blue. Under cultivation sudden variations from yellow to white have been observed. A double yellow hollyhock, according to Darwin, suddenly turned one year into a single white kind, and a chrysanthemum has been seen to bear both yellow and white flowers. It will be observed in the accompanying table that in all families in which yellow flowers are common, white are also common, except in the *Hyperaceæ*, which contain no white-flowered species. Some species of mustard regularly fade to white, while many white flowers

The Predominant Colors of the Flowers of Ranunculaceæ to Cornaceæ in the Northern States.

	Yellow.	White.	Red.	Blue.	Green.	Total.
Ranunculaceæ	19	19	2	14	6	60
Magnoliaceæ	1	4	..	..	1	6
Anonaceæ	..	..	..	1	..	1
Menispermaceæ	..	2	..	..	1	3
Berberaceæ	2	3	..	..	1	6
Nymphæaceæ	3	2	..	1	..	6
Sarraceniaceæ	1	..	..	1	..	2
Papaveraceæ	4	2	2	..	..	8
Fumariaceæ	2	3	2	1	..	8
Cruciferæ	17	37	2	5	4	65
Capparidaceæ	..	1	..	..	..	1
Resedaceæ	1	..	..	..	..	1
Violaceæ	4	6	..	8	..	18
Cistaceæ	4	..	..	..	4	8
Droseraceæ	..	3	1	..	..	4
Hyperaceæ	18	..	2	..	..	20
Elatinaceæ	..	..	..	..	1	1
Caryophyllaceæ	..	32	15	..	6	53
Portulaceæ	1	..	3	1	..	5
Malvaceæ	5	4	10	3	..	22
Tiliaceæ	..	2	..	..	..	2
Camilliaceæ	..	2	..	..	..	2
Linaceæ	3	..	..	1	..	4
Geraniaceæ	3	2	2	6	..	13
Rutaceæ	..	2	..	..	1	3
Anarcardiaceæ	1	..	..	..	5	6
Vitaceæ	..	..	..	..	7	7
Rhamnaceæ	..	3	..	..	4	7
Celastraceæ	..	..	..	2	1	3
Sapindaceæ	2	2	2	..	5	11
Polygalaceæ	2	3	4	5	..	14
Leguminosæ	19	28	6	61	2	116
Rosaceæ	19	44	13	2	2	80
Calycanthaceæ	..	..	..	3	..	3
Saxifragaceæ	2	20	..	1	13	36
Crassulaceæ	2	3	1	2	1	9
Hammelaceæ	1	1	..	..	1	3
Halorageæ	..	..	..	..	9	9
Onagraceæ	15	2	4	5	4	30
Melastomaceæ	..	..	..	3	..	3
Lythraceæ	..	1	..	8	..	9
Loasaceæ	1	..	..	..	..	1
Cactaceæ	3	..	..	..	..	3
Passifloraceæ	1	1	..	..	..	2
Cucurbitaceæ	..	2	..	..	1	3
Umbelliferæ	8	33	..	2	2	45
Araliaceæ	..	3	..	..	3	6
Cornaceæ	..	11	..	..	2	13
Total	164	283	71	136	87	741

show that they are descended from ancestral yellow forms by retaining vestiges of this color on the base of the petals, as in the water-crowfoot. The pale yellow flowers of *Œnothera laciniata*, of the cultivated *Ribes aureum*, and of *Diervilla trifida* in fading change to rose or red, exhibiting a tendency to develop red coloration. *Aquilegia canadensis* produces scarlet flowers, which are yellow inside and rarely all over. There are two other species in the Northern flora which exhibit similar coloring, *Lonicera sempervirens* and *Spigelia marylandica*, and the former is sometimes yellow throughout. *Myosotis* is at first pale yellow, and changes to sky-blue. But the best illustration of the transition from yellow to blue is exhibited by the violet family; the smallest and simplest species is yellow, the most highly specialized is blue, and all the intermediate stages are presented by *Viola tricolor*.

Honey-guides are exceedingly rare among yellow flowers. *Cassia chamæcrista*, which has nearly regular, showy yellow flowers, has two or three petals with a purple spot at base, while four of the anthers are yellow and six purple. It is interesting to compare with this flower the change of color presented by *Arnebia*. When the flower opens, each lobe of the yellow corolla is marked by a dark purple spot, which soon begins to fade, and by the next day has entirely disappeared. *Saxifraga aizoides* has golden flowers spotted with orange, and attracts a large number of insect visitors, and the yellow violets have their petals marked with dark-brown lines leading to the honey glands. Sulphur-yellow flowers are visited chiefly by bumblebees, and their coloration seems to have been developed by their selective influence from red or purple-flowered ancestors. Müller observed that the sulphur-yellow flowers of *Sempervivum Wulfenii*, which are unlike the primitive yellow of the *Crassulaceæ*, are purple at base. This purple coloring he believed to be a remnant inherited from an earlier purple-flowered form. *Hibiscus trionum*, which is sulphur-yellow with a blackish eye, has perhaps been derived from a red-flowered ancestor, for the three other species of the genus are rose or flesh colored.

White flowers, in the opinion of the writer, are due to retrogression, and are derived from yellow, red, or blue, and in some instances from the primitive green, as in the involucre of *Cornus*. As a whole they present no advance in specialization over yellow flowers, and are often smaller and less conspicuous. When the petals of blossoms containing yellow, red, or blue pigments are placed in concentrated alcohol they turn to white. To produce these pigments is evidently more or less a tax upon the energies of the plant, which, whenever possible, is avoided. They are not present in the embryonic buds, and may not develop until they are well advanced in size. In *Gentiana crinita* the yellowish-white bud is nearly an inch long before the purple coloring appears, and the corolla always remains white at base. A stimulus to the growth of the plant makes itself apparent in the increased brilliancy of the flowers, as when they are exposed to clear sunlight or are treated with nitrate of soda, and may also be observed in the flushing of tulips, by which they lose their variegated colors when treated with strong manure. On the other hand, a check in nutrition and growth will cause a diminution of the perianth in size, accompanied by retrogression in color. When double red poppies are transplanted the whole plant is dwarfed, while the flowers are much smaller and pure white. This view of the origin of white flowers explains why they are the commonest in Nature, accounts for their being most numerous in families in which yellow flowers are likewise numerous, and why they are most true to name under cultivation. Many white flowers also exhibit other evidences of degeneration in their structure. Numerous species of *Cruciferæ* and *Caryophyllaceæ* have small white flowers, which regularly fertilize themselves; and in *Lepidium*, *Stellaria*, and *Sagina* the petals are sometimes present and in other instances are wanting.

White flowers often develop red or blue coloration. It is interesting to note that the red and white varieties of the hyacinth were derived from the wild blue form earlier than the yellow. Darwin gives an instance of a white and red rose produced on the same root, also of white and pink flowers on a single plant of *Antirrhinum majus*. *Cratægus oxyacantha*, a dark pink hawthorn, has been known to throw out a tuft of pure white blossoms. Every stage of the transition from white to red is placed before us by the rose family. The thorns are white, rarely tinged with rose; in the pear and apple the flowers are white, regularly shaded with red; and one of the *Spiræas* is rose, rarely white, while in the roses proper the six species are rose-colored, but the prairie rose changes to white. Under cultivation the wild geranium has been seen to produce upon the same plant both white and blue flowers. Good examples of the transition from white to blue and from blue to white may be met with in the *Ranunculaceæ* and *Leguminosæ*. *Delphinium tricorne* is bright blue, sometimes white, *Viola canadensis* has the petals white inside but the upper ones tinged with violet beneath, *Astragalus* has a part of the species white and a part purple, while it is common to find blue and white varieties of *Hepatica* growing on the same grassy bank. White flowers pass more readily into red, blue, or yellow than any one of these colors can be converted into any other, since it is easier to develop a new pigment than to transform one already existing. This is confirmed by the experience of florists, who always seek to obtain a white variety from which to develop the desired hue.

Red flowers are much rarer than blue, and both are seldom common in the same family. For instance, in the pink family red and white blossoms prevail, and there are no blue shades. The pinks are crimson and scarlet, often with elegant markings and a strong aromatic odor. The honey is deeply concealed, and they are visited almost exclusively by butterflies and millers. Twenty-eight species of diurnal *Lepidoptera* have been collected upon a single variety of *Saponaria*. Of the eighty species of *Rosaceæ*, thirteen are red and two purple, but the forty-four white flowers are very generally tinged or tipped with red. The two purplish-flowered species, *Geum rivale* and *Potentilla palustris*, belong to genera in which yellow predominates, and this primitive color is still evident in both their calyx and corolla. There are no blue or violet flowers. This family exhibits a marked tendency both in stem, leaf, bud, flower, and fruit to develop reddish coloration, a tendency which is probably due to the chemical constitution of the sap. There are no flowers in this family adapted to *Lepidoptera*, but they are visited by a mixed company of flies, beetles, and *Hymenoptera*. The smaller and less specialized *Rosaceæ* are yellow and white and are visited by a variety of short-lipped insects. With the increase of the flower in size and conspicuousness the number of insect visitors greatly increases, and the enlargement of the flower is attended by red coloration. Owing to the chemical constitution of the nutritive fluid, probably to its acidity (for when the petals of a rose are treated with ammonia they become blue), there has been no opportunity for the development of blue coloration by insects. With the enlargement of the perianth and the increased flow of sap, red tints have tended to appear by process of oxidation.

The correlation of red coloring with an increased flow of sap is well illustrated by the galls of the wild-rose tree, which are often "as rosy as the rosiest apple." An abnormal flow of sap is caused to the part stung by the insect, and red coloration is due to the action of light, for it is of no service to the plant. Again, when the flowers of *Cratægus coccinea* are stung by the gall-fly the different organs all become bright red, and the change in coloring is accompanied by an increase in size. In some instances red colors, according to Darwin, indicate greater vigor on the part of the plant, and I have also observed that the dwarfing of red flowers under cultivation may cause them to revert to white.

It was long, indeed, believed that the same species could not produce yellow, red, and blue flowers. But this doctrine, to use the words of Dr. Lindley, "must now be laid up in the limbo of pleasant dreams." This supposed law is contradicted by the hyacinth, pansy, *Delphinium cardinale*, and many other plants. Though red and blue coloring never occurs among the roses, a hyacinth has been seen to produce a perfectly pink and a perfectly blue blossom on the same truss, and the *Borraginaceæ* afford examples of flowers turning from red to blue in even a short space of time.

Blue is the highest color of the floral world, and is preferred by bees. Blue flowers are, as a rule, highly specialized both in form and color, and often possess marvelous mechanisms which aid in disseminating the pollen. This coloring is very common in the mint and pulse families, and in this district there are in the former forty-nine and in the latter sixty-one species of blue flowers. Their structure is such that few insects besides the long-tongued bees can gain access to the honey, and in some instances a single species of flower is visited by a single kind of bee, as one of the larkspurs by one of the bumblebees. While this high specialization of the flower may insure intercrossing, it is yet open to many objections, such as scarcity of proper guests, mechanical imperfections, perforation of the flowers by bees, and development of the perianth at the expense of the essential organs.

It is noteworthy that when genera occur containing three or more species they are seldom all blue or purple; one species at least, and frequently more than one, is yellow, white, or red. In *Trifolium*, *T. pratense* is rose-purple, *T. repens* white, and *T. agrarium* yellow. In the genus *Astragalus* a part of the species are violet or blue and a part white, and the same is true of *Lespedeza* and *Vicia;* in *Lathyrus* three species are blue-purple, one yellow, and one yellowish white. It is probably more advantageous in these genera for a part of the species to be of one color and a part of another than for all to be blue. When species are closely allied bees tend to visit them indiscriminately, as has been observed to be true of the buttercups, *Spiræas*, and golden-rods. During an afternoon the writer carefully collected the insect visitors to *Solidago bicolor*, our only cream-colored golden-rod. Both the number of species and of individuals taken was much larger than upon the yellow-flowered and more abundant varieties of this genus growing near by. There could be no doubt that the whitish coloration was beneficial in enabling insects to distinguish it more readily. Many purplish flowers are regular, often showing indications of degeneration, are devoid of honey, and are self-fertilized or adapted to *Diptera*, or, as in *Hepatica*, which is visited by bees for the pollen, open to a wide circle of visitors. In the sea purslane (*Sesuvium maritimum*), a prostrate maritime herb, there are no petals, but the five-parted calyx is purplish inside. The genus *Ammannia* of the *Lythraceæ* has the petals small, purplish, and in one species they are wanting; the axillary flowers of *Bracenia purpurea* are small and dull purple; in the common papaw the lurid purple flowers are large and adapted to *Diptera*, as are probably the lurid purple flowers of *Calycanthus*. Blue flowers may revert to red, white, or yellow. The fringed *Polygala* of Britain is usually bright blue, but often reverts to pink and white; there is a pure white variety of the blue-eyed grass; *Mertensia virginica* is purple-blue, rarely white; the larkspur is bright blue, sometimes white, and a white variety of the purple *Trillium* frequently occurs; there is, indeed, no improbability of a white-flowered form of every species being discovered. *Viola calcarata* is normally blue, but sometimes changes to the ancestral yellow.

The possession of a strong scent may, however, in many instances more than compensate for the absence of color. This is well illustrated in *Lepidium sativum*. The flowers are small and inconspicuous and in rainy weather do not fully open, yet, as it is odoriferous, Müller found it more abundantly visited by insects than any other crucifer. It is their strong odor, rather than their color, that renders so many umbellifers so attractive to a great variety of insects. Nocturnal flowers, which are visited by moths, are usually white and sweet-scented, though the evening primrose is yellow and *Saponaria officinalis* is rose-colored. Kohler and Schübeler have shown that a larger proportion of white flowers are fragrant than of any other color. Of 1,193 white flowers examined by them, 187 were odoriferous; of 951 yellow, 75; of 923 red, 85; of 594 blue, 31. But neither color nor odor will long alone serve to insure the visits of insects. The common elderberry exhibits the disadvantages which may attend the want of honey when there is but a limited supply of pollen. There are great masses of odoriferous flowers which convert the shrub into a huge bouquet, but it blooms at midsummer, when it must contend with many nectar-yielding plants. As a result, it is almost wholly deserted by insects. Only four species of flies have been taken upon it, and repeatedly the blossoms were examined without discovering a single visitor, and yet upon the jewel-weed and the red-osier cornel, a few yards away, scores were at work.

Among the more recent applications of electricity is one for the desiccation of wood, by the Nadon Bretonneau method, by which wood is made as fit for use for certain exact processes in as many months as it has formerly taken years. It is also proposed by Mr. Shaw, an English mining engineer, to substitute water and steam for gunpowder in mine blasts, a cartridge of water being placed instead of the powder cartridge, and vaporized by passing the electrical current through it.

SKETCH OF OSCAR SCHMIDT.

OSCAR SCHMIDT was characterized by Ludwig von Graff, his successor at Grätz, as a real naturalist who, keeping up with the advances of science and philosophy all his life, as a zoölogist spanned the whole domain of that science, giving equal interest to every part and branch of it. The animal as a whole, as a living being in the series of organisms, was the object of his concern, and all the parts of the animal and all the processes that go on within it were alike interesting and important to him; and the ultimate purpose of his study of that object was to gain from the facts disclosed a philosophic view of Nature.

Eduard Oscar Schmidt was born at Torgau, Prussia, February 24, 1823, the son of a military chaplain who was descended from an old family of clergymen—"a man of fine Saxon culture, with no very great taste for theology, and open-minded to a ripe old age," and who died in 1875. His mother was of French and German (Hamburg) descent, and counted the great Aristotelian Petrus Ramus among her ancestors. The father was a gentle instructor to the son; and the latter, attending in the intervals of study to duties of the household and the farm and making good use of his opportunities for relaxation, enjoyed a young life that was invigorating to mind and body. He thus acquired tastes that led him frequently in his later life to leave the city and his study and go into the country to build and plant, whereby he endeared himself to the Badenese farmers. On rainy days and winter evenings, as he gleefully told of himself in 1858, the boy of eleven or twelve years of age entertained himself and had his fancy stimulated by reading Campe's old accounts of his travels. He thus became interested in geography, and acquired a thirst for travel that was never quenched.

Having finished his elementary schooling at Weissenfels, on the Saale, where his grandfather had served as superintendent, he went in 1836 to the celebrated Royal School at Pforta, of which his father was an alumnus, and whither he himself took his son thirty years later. He was much impressed by the teaching of Koberstein, the historian of literature, who unlocked for him the world of Goethe and of romance; and he went out from Pforta into life with a full conviction that the soundness of our culture depends upon its humanistic foundation. He went to Halle in the fall of 1842 to fulfill his military obligations and study mathematics and natural science, and became interested in other branches. At the Berlin Hochschule, whither he went next, he further broadened the scope of his culture, pursued philosophical studies, and finally settled upon the organic sciences. His interest was gradually diverted from mathematics, and he took up zoölogy with enthusiasm. Johann Müller—whose portrait, his son Erich Schmidt says, in the memorial address from which we draw most of the facts of his life, always adorned his room—permitted him, in 1845, after a summer term in comparative anatomy at Heligoland, to take part in a research upon sea animals, and impressed a stamp on the young investigator's view of Nature that lasted till the Darwinian revolution. Christian Gottfried Ehrenberg interested him in the investigation of the minute life of the infusoria, and, besides being his teacher, had a fatherly affection for him.

In 1846 Schmidt obtained a promotion to Doctor of Philosophy at Halle, the subject of his still unprinted dissertation being the sacred *Scarabœus*. He passed the higher teachers' examination in Berlin, and thereby avoided a year of probation at a realgymnasium. In August, 1847, he habilitated himself at Jena. He presented, on the occasion, a paper entitled Morphological Fragments, in which, while the name of Oken was mentioned appreciatively in the introduction, the gap between his philosophy and the current zoölogy was insisted upon. He became Professor Extraordinary of Natural History in this university in 1849, and Director of the Grand Ducal Zoölogical Museum in 1854. While at Jena he published the Handbook of Comparative Anatomy (1849), the Hand Atlas of Comparative Anatomy (1852), and a historical study on the Development of Comparative Anatomy (1855). Some results of a journey to the North in the course of his studies of the *Turbellaria* were embodied in a lecture on the Faroe Islands (1848), and Pictures from the North, collected during a Journey to the North Cape (1854), a versatile work, in which his sharp powers of observation were well illustrated. A work of somewhat different character was a lecture on Goethe's Relation to the Organic Natural Sciences, which was delivered in the Berlin Singakademie and was printed in 1853.

Having occupied the professorship at Jena for seven years on a salary never exceeding one hundred thalers, and after declining an invitation to Prague, Schmidt in 1855 accepted the appointment of Professor of Zoölogy in the University of Cracow. The conditions at this institution were quite different from those which had surrounded him at Jena. He received more liberal allowances than had been granted him there; but political affairs were disturbed, and he withdrew in 1857 to become Professor of Zoölogy and Comparative Anatomy, and eventually rector, at Grätz. Here he spent the fifteen most enjoyable and most fruitful years of his life, of which his son, Erich Schmidt, has given, in his memorial address, a most pleasant picture. "In the magnificent scenery," he says, "among which he often wandered with his growing children, with warm-hearted men around him, sure of the increasing affection and capacity of his students, he reached his culmination as a naturalist and as a man. He was active in every direction. The university was in a very promising period of its career. A medical faculty was required, and that magnified his function. He also represented his department in the Johanneum, and presided over the museum. He went every year to Dalmatia while he was composing his monograph on the sponges, and made experiments in their artificial cultivation, being given one year a small war steamer at his disposal. These journeys were doubly enjoyed when Franz Unger went with him to Lesina or to the Ionian Islands. He and the great botanist had a close community of interests, and it was an inestimable privilege, during the great scientific crisis, to stand shoulder to shoulder with an older man, who to power of following philosophical intricacies united the habit of the most exact research with finely trained effort and suggestive intuition. Together the two devoted themselves to the study of Darwinism, at first opposed to it, as is shown by one of Schmidt's printed essays, but soon becoming impressed with the conviction that all scientific progress was connected with that revolution, and finally Schmidt gave all his energy to the advancement of it. As Rector Magnificus—the first Protestant to wear the golden chain at an Austrian university—he declared himself, in his inaugural address, for Darwinism with a resoluteness peculiar to him, and neither the silly demonstrations of the theological students nor the wrath of Cardinal Rauscher could intimidate him from the vindication of free investigation. . . . The rectoral year 1865–'66 was also the year of the Austro-Prussian War, and he now proved that the rashly progressive man to whom the whole clash of opinions was a bath of steel also possessed a considerable measure of self-control. He bore himself correctly in every sense in his difficult position, and, without turning his back upon his native Prussia, he so completely devoted himself to the care of the wounded as to receive a note of thanks from the General Archduke Albrecht. Having been chosen a deputy to the Landtag, his voice was always heard in favor of the Liberal side. He served indefatigably in the communal council and the school board. The Protestant communes depended upon him as one of their most effective champions, even to the end of the partisan contest. Besides all this many-sided scientific and public-spirited activity, Schmidt had time to describe the lower animals for Brehm's *Thierleben*, and to write a number of popular treatises. A lively social disposition bound him to numerous colleagues, and on the whole he felt so much at home in Grätz, especially after he had a new institute and a share in the direction of a zoölogical station at Trieste in prospect, that he had no thought of a change. He declined invitations to Marburg and Dorpat. He was always favored by the Government, and kept the marks of its consideration faithfully in memory."

Ludwig von Graff describes three plainly marked periods in Schmidt's scientific career. The first, the beginning of which coincided with his entrance into his scientific professorship, was characterized by his labors on the *Turbellaria*, from which he was only occasionally diverted during his residence at Jena and Cracow. "The observations on infusoria, radiates, and tapeworms, the structure of the annelids and the development of the mollusks, the descriptions of new amphibia, and the important discovery of the crustacean nature of the peltogasters, were, we might say, only rests in the uninterrupted course of the *Turbellaria* studies; and that Schmidt was constantly returning to them was not merely because particular interest had been devoted to them in Germany at that time only by M. Schultze and R. Leuckart, for other animal groups had fared no better among the then small number of scientifically working zoölogists, but Schmidt had won his earliest scientific fame with his little book on the fresh-water *Rhabdocœlas* (1848), and had by means of it entered the circle of recognized investigators. He gave in this book the first connected presentation of the whole organization of a group of animals, the diversity and great abundance of which in fresh water were hardly suspected, and the anatomy of which consisted of few and imperfectly understood isolated data; described new systems of organs in them, and based an improved classification on their remarkably complicated and variously graded structure, with new families, genera, and species. The little book was therefore received with much interest. A journey to the Faroe Islands in 1848, and his first excursion to Lesina in 1852, followed in 1856 by a journey from Cracow to Nice and Naples, enabled him to increase the number of new species, and permitted an insight into the great diversity of forms, without, however, giving him time for accurate anatomical investigations, for the nature of the objects promised a considerable advance in this direction only at the cost of tenacious patience and untiring industry. His subsequent labors on the *Rhabdocœlas* of the vicinity of Cracow, the *Dendrocœlas* of the vicinity of Grätz, and his researches on the *Turbellaria* of Corfu and Cephalonia, which (in 1861) closed this period of his career as worthily as it had begun, proved that Schmidt possessed both these requirements. These labors, if he had accomplished no more, would have been sufficient to give him an honorable position in science for all time.

"The second period begins in Grätz. Some contributions to the knowledge of the prehistoric vertebrate fauna of Steiermarck resulted from Schmidt's keen observations of Nature during an excursion in the Alps. But the Adriatic, so near, enticed him into new paths, and offered an inexhaustible field for work in the sponges. Aside from his contributions to the theory of the *Bathybius* and to the systematics of the *Gephyrea*, the sea sponges constituted the object of his studies during the whole period of his residence in Grätz, and were the occasion of yearly journeys to the Adriatic coasts. The results reached by Schmidt in this field placed him in the foremost rank of contemporary investigators, while his occupation with the sponges marked the completion of a revolution in his view of Nature by converting him to Darwinism. After his work the characteristic fluid form of the sponges became a classic subject in the study of the transmutation theory.

"At the time of the appearance of Schmidt's first work on the sponges of the Adriatic (in 1862), just enough of their anatomy and physiology had been made known through individual labors, especially those of Lieberkühn, to prove their animal nature; and then, also, the sponges first found a place in the fifth edition of Schmidt's Handbook of Comparative Anatomy. But any one who undertook either in the Adriatic or the Mediterranean to make his way through the immense wealth of the forms would have found himself without help of any kind. It was therefore Schmidt's purpose to lay the basis, through exact description and definition of the forms, for continued investigation through which the study might be further advanced. He carried out this purpose, recognizing in the skeleton parts what survived amid the changes, clearly defining the species and genera, nineteen of which were new, and brilliantly demonstrating his talent in systematization. While in the first supplement, in 1864, which brought up the histology of the sponges, he still acknowledged himself an adherent of the old school, he expressed the hope in the second supplement that science might some time come upon the track of the genealogical relations of species; and, in the memorable rector's address of November 15, 1865, he openly signalized his passage to the new theory, and proclaimed it, with all the youthful enthusiasm and carelessness as to consequences characteristic of his nature, as the gospel of the research of the future.

"The idea of utilizing the great reproductiveneness of the sponges for artificial cultivation was suggested to Schmidt during his studies of the Dalmatian fauna, and his experiments in this direction made his name well known in the Austrian coast land and far beyond. After the publication of an article on the subject in the *Wiener Zeitung* he was requested, by the Imperial-Royal Ministry of Trade and National Economy, to make a special presentation of his views respecting the possibility and methods of cultivating sponges artificially in Dalmatia. He first asked for means for experimenting, as furnishing the prime and most essential method of determining where and how a sponge culture could be instituted with the best prospect of success. The request was not granted, but Schmidt was requested to furnish data respecting the provisions and measures within reach which might be employed with advantage till further information could be obtained concerning the adaptability of sponges to propagation from such local experiments as might be carried on through the industrial and commercial chambers of Dalmatia. The Notes on Sponges in the Adriatic Sea and an article of similar import in the *Triester Zeitung* of March 12, 1862, were the answer to this request, and they were followed by Schmidt's having placed at his disposal, by the exchanges of Trieste, in the next season, money and the control of the war steamer Hentzis for use in scientific and practical investigations on the Dalmatian coast. With the assistance of his brother, Eugen, he carried his experiments to a successful issue at Sebenico, Zlarin Valle Socolizza on Lesina, Curzola, Lagosta, Meleda, and Ragusa, but especially in the more favored stations of Zlarin and Lesina, and demonstrated the possibility of artificial propagation. In order to test the practical value of the experiments, propagating stations were established on the island of Lesina and visited by Schmidt every spring. The results of the experiments were presented in a report to the Imperial-Royal Ministry of Commerce and National Economy, in which the possibility of artificial propagation was emphatically affirmed."

Unfortunately, the Dalmatines have not been quick enough to take advantage of the opportunity thus offered to them to establish a new industry on their not very busy coast. Bucchich continued Schmidt's experiments till 1872, but no capitalists have been found to establish the cultivation of sponges on an extensive and permanent scale.

Another enterprise, however—the Zoölogical Station at Trieste, to which Schmidt for a time devoted all his energy—has had a more fortunate realization. The plan of it was developed by Carl Vogt, but it would never have been erected if Schmidt's practical sense had not adapted the plan to the actual needs of the case and the financial conditions imposed by the state, and if he had not given the weight of his personality to the accomplishment of it.

The erection of a German Empire at the conclusion of the Franco-Prussian War was an occasion of proud and exultant joy to Schmidt; and when, in the spring of 1872, he was elected, at the instance of his friend Haeckel, a professor in the newly instituted university at Strasburg, he deemed it a patriotic duty to accept.

With his removal to Strasburg, what both Erich Schmidt and Professor von Graff call the third period of Schmidt's scientific career began. It was a period of undisturbed ease in his home life, and was devoted chiefly to the continuation of the studies of the sponges, with a few special researches, the results of which appeared in books, on the theory of descent, fossil animals, on Hartman's theories, and on social democracy. His systematic and anatomical labors on the sponges—the provisional conclusions of which, in 1870, constituted the *Grunzüge einer Spongienfauna des Atlantischen Gebietes* (Outlines of a Sponge Fauna of the Atlantic Region)—were carried on, Professor von Graff says, from the point of view of the development theory. Besides several smaller contributions to the building up of the theory of descent, the most important of all his works of this time is his book on the Theory of Descent and Darwinism (Appletons' International Scientific Series)—"one of the best presentations of all the questions pertaining to that subject, and distinguished from other similar works both by the philosophical spirit with which the whole discussion is carried on, and by the even consideration it gives to all the various fundamental points of the principle of descent. The prominent features of Schmidt's presentation appear most especially in the final chapter, the subject of which is the Application of the Theory of Descent to Man, which he had also previously discussed in a public address. Shortly after this he reduced to absurdity, in a very forcible attack on Hartman's Philosophy of the Unconscious, the idea of the Social Democrats that they could use Darwinism to the advantage of their Utopia, and treated the subject of the Mammalia in their Relation to Primeval Times (Appletons' International Scientific Series) most vigorously from the point of view of the development theory." He also found time for special researches on the Structure and Development of Loxosema, the Eyes of Arthropods, and, still keeping up his studies of the sponges, closed his more than twenty years' labors on this group with his Sponges of the Gulf of Mexico, and his last scientific work—Derivation of New Species through the Decay and Atrophy of Older Characteristics. The preface to the former work, Professor von Graff says, shows plainly how Schmidt, in contrast to so many fellow-laborers in the field of the theory of descent, was always circumspect in a high degree, and never suffered himself to be carried so far in his zeal as to leave the ground of facts. Although a champion of monophyletic derivation, he did not overlook the facts that might be brought to bear in favor of a polyphiletic origin.

During the later years of his life Schmidt visited Heligoland, and enjoyed the sea air, which seemed to have become necessary to him, during two winters at Dohrn's Institute at Naples, in southern France, and at Grado, and attended the meetings of naturalists at Leipsic, Wiesbaden, Salzburg, Baden-Baden, Munich, Cassel, and Freiburg, where he was a welcome guest and a prominent speaker. In September, 1885, as president of the Zoölogical Section he entertained his fellow-specialists at his house. A slight stroke of apoplexy, which he suffered in the summer of 1882, passed away without seeming to leave any trace. He spent the Easter season of 1885 with his son's family in Vienna and with Graff in Grätz. He intended to speak on Easter of 1886 in Weimar and to visit Jena, "whither he expected to return in his sixty-fifth year so as to attach a good end to a good beginning." But on the morning of January 9, 1886, after he had spent the previous evening in pleasant social intercourse, there came another stroke. He never recovered consciousness, but died on January 16th.

Professor von Graff describes Schmidt's method of teaching as one encouraging the students to pursue their own ways of thinking. He did not expect formal theses from them, but, having indicated the theme, left them to work it out according to their own logical processes, and as often let them choose their own subjects. Having found a pupil's bent, he sought to turn him into a corresponding course, "and never tried to make a poor naturalist out of one who might become a good doctor or teacher." In his lectures he was earnest and enthusiastic, not as good a speaker as writer, and sometimes betraying his trouble to find the right word; "but he knew how to win the love of his pupils for his subject, and, while trying to make the comprehension of the matter not too difficult, to keep interest alive by occasional glances at the theoretical significance of the facts. It was very far from his purpose to make pastime for his hearers, and, when he was polemical, every one had to be made sensible of the purely technical bearing."

Professor Schmidt's literary work covered a field of extraordinary breadth. Besides numerous works and text-books in systematic and anatomical zoölogy and life histories, he published popular lectures and essays in many different periodicals, recensions, reviews of books, translations, and even political articles. It would be impossible to give a complete bibliography of his works, because he left no notes respecting them. A list of his publications in zoölogy, by Professor von Graff, includes ninety-nine titles.

Correspondence.

SCIENTIFIC METHOD AND THE BIBLE.

Editor Popular Science Monthly:

SIR: I have read with great interest an article in the July number of your Monthly entitled Scientific Method and its Application to the Bible. So far as I am able to understand the writer's views, I must certainly decline to accept some of his conclusions. The vital teaching of his paper appears to me to be this: it is proper to apply scientific methods to the study of the Bible so far as to inquire into its structure, the date of its composition, its composite authorship and the sources from which it was compiled, and the names of its authors; but certain truths are distinctly taught in it of a supernatural character which must be accepted because they are a revelation of God's will, and not because they are found to be true by intellectual apprehension and logical reasoning. Indeed, to think of understanding them by intellectual processes is "unscientific beyond hope of pardon."

It is conceded that "the stifling of thought and of investigation into what might lead men away from the truth and the faith once delivered to the saints" was instrumental in causing the barrenness in scientific work for twelve hundred years of the middle ages, between Hipparchus and Copernicus, and that "the same causes are more or less at work at all times to hinder the growth of science and the extension of scientific method." He still, however, insists that there is limitation to human inquiry and ecclesiastical bounds beyond which thought must not go. There are still revelations of truths which the intellect can not perceive, and which can only be understood by "an exercise of faith." It is no longer the Mosaic line which scientists are forbidden to cross, but the "spiritual verities" must not be questioned. There are some revelations which, in the language of Huxley, "they are to hold for the certainest of truths, to be doubted only at the peril of their salvation."

Was it not Martin Luther who called Copernicus a "fool" for trying "to reverse the entire science of astronomy" in the face of revealed truths? "To accept the truth as revealed by God and to acquiesce in it is the part of a good mind," said Melanchthon in condemning Copernicus. "Who will venture to place the authority of Copernicus above that of the Holy Spirit?" said Calvin. Verily, his unpardonable sin was "investigating the truths which are distinctly taught in the Bible," which required an "exercise of faith" and were not to be "apprehended intellectually."

The question seems a reasonable one to ask, To what authority shall we look for knowledge and interpretation of these spiritual truths which are not accessible by scientific study? How shall we know that they are truths at all? I am aware that here the testimony of Christian conscientiousness is sometimes held to be the court of last resort, which I interpret to mean that if one intuitively reaches the conclusion that something is true it is true, the most positive evidence to the contrary notwithstanding. Certainly, no other fact is better established in all human history than the truth of witchcraft, if we admit the potency of this authority. If we reject this, must we not then fall back upon ecclesiastical infallibility as the final interpreter of truth? And this the essayist, in his paper, declines to argue.

Now, can there be any such thing as scientific investigation within such prescribed limitations? Or scientific study of the Bible itself which excludes from its province the so-called spiritual revelations which it contains? One might naturally think that the primary purpose of all the critical study of the books, authors, and structure of the Bible was to learn just what these distinct truths it teaches are. But what bearing can this study have upon the question, being but an intellectual process with which the essential truths are disconnected, which only come by revelation?

Higher criticism can not hold permanently such an untenable position. It must either go backward to an infallible book, or an infallible interpretation of it by authority, or it must go forward to the consideration of the Bible as a collection of books of ancient literature, to be examined without restrictions. The truths which it contains are to be ascertained by "apprehending intellectually" and "reasoning logically," in the same manner as with other books written by religious leaders in ancient times. Any halting between these two positions is only for temporary rest. No permanent foothold can ever be gained on such a foundation of quicksand. An impassable dead line in biblical study is indicative of the theological and not the scientific method.

LEWIS DAYTON BURDICK.

McDONOUGH, N. Y.

A CORRECTION.

Editor Popular Science Monthly:

SIR: A correspondent, Mr. C. Wood Davis, of Peotone, Kansas, appears to think it his duty to prove that we can not produce wheat enough in this country to meet our own future demands, and apparently regards it as a personal matter when any one contests this position. He also thinks he has found a small error in long division in the last article which you printed from me on this question which I can not find, but which if found and corrected would have no influence on the general argument.

He also rebukes me in a most earnest manner for the alleged misuse of the chemical term "phosphate of potash," which crept into my article in connection with the right use of the term "phosphate of lime," when I referred to the mineral phosphates of Kentucky, Tennessee, and Florida. Technically he is apparently right. There is no permanent form or no natural mineral form of phosphate of potash which can be removed from place to place. Yet my article was revised by an experienced geologist, thoroughly familiar with the chemistry of the soil, before I sent it to you, and he failed to correct this technical error. My own knowledge of chemistry is very limited.

It might be inferred, as my irascible correspondent points out, from the manner in which I have called attention to the deposits of mineral phosphates in Kentucky and Tennessee, that I thought these deposits would yield phosphates of lime and phosphates of potash each in a separate movable form, which could not be a fact. Yet my critic will doubtless admit that the soils of many parts of this country are stocked with potash sufficient for a very long period.

Many years ago, when I began the study of the cotton plant and its growth, under the leadership of the late Prof. William B. Rogers, I made reference to the existence of the vast supplies of phosphate of lime and potash, which are necessary to the growth of the cotton plant, in the Southern soils. I derived my conception of their origin in the lowlands and plateaus in marine formations from Professor Rogers, and also from the works of Professor Shaler. One may also impute the large amount of potash that is found in the valleys and mountain lands to the disintegration of the gneiss and other rocks of the Appalachian chain, which have never been washed out by glacial action or by glacial streams. If any one has been misled by this slight misuse of chemical terms it may be well to state that phosphate of potash does not exist, and I am told that it can not exist, in a separate removable form.

We have not as yet discovered any large deposit or mine like that of Stassfurt, in Prussia, yielding potash in a commercial form in which it can be widely distributed. We import annually thousands of tons of potash from Stassfurt. This deposit was discovered, as I am informed, by accident, and it may be hoped that a similar accident may occur in this country. These mines were originally opened for the production of salt. In boring for salt the product of a stratum above or below the salt, I know not which, was brought up, which was thrown aside as worthless until an inquisitive visiting chemist examined it and thus discovered this great source of potash. We possess enormous beds of salt, of soda, and of alkalies, scattered throughout the area of this country, in connection with which it may be hoped that we may hereafter discover a deposit of mineral potash, or of the mineral from which potash may be derived cheaply and in large quantities.

These two exceptions which have been taken to my article have no real connection with the substance of the argument, which stands independently either of the undiscoverable error in long division or of the technical fault in the use of the term "phosphate of potash." Yours very truly,

EDWARD ATKINSON.

BOSTON, *June 7, 1899.*

Editor's Table.

AN OLD-FASHIONED MORAL.

VOLTAIRE'S Candide is not a book that can be recommended for general reading; yet it contains perhaps as good a moral as could easily be found in a wide range of books aiming more distinctly at edification. The hero, after many vicissitudes and copious experience of the deceitfulness of riches and the miseries of an ill-regulated life, made the blessed discovery that peace and health and independence were to be obtained by the industrious cultivation of a small piece of ground. He had a friend called Martin who associated himself with him in his agricultural labors, but who had rather a fine talent for discussing abstract questions. Candide would listen to him for a while, but never allowed him to get very far without breaking in with the observation, "Mais surtout il faut cultiver notre jardin" ("But above everything else we must cultivate our garden"). Here was safety, here was balm for painful recollections, here was about the best that the world had it in its power to give; and Candide, chastised by misfortune, wanted to stick to that.

This is an age of copious and unending discussion of social and political problems. Discussion is well in its way; but perhaps the problems would not be so acute if there was less discussion and more cultivating of gardens. It may indeed be said, with no small degree of plausibility, that the greed to be rich, the unwillingness, so to speak, to cultivate a garden which only promises a moderate reward, is at the bottom of a large part of our troubles. Wisdom cries aloud and tells the world that happiness is not to be found in riches; but the cry is little heeded. The whole lesson of higher education is that happiness springs from within and not from without; but thousands take what they can of the higher education while declining the lesson. Science unlocks a world of beauty and wonder, and offers to the mind a constant succession of interesting subjects of contemplation; but thousands again ask nothing of science except to show them the way to wealth. Precisely similar in a multitude of cases is the demand made of art and literature. It is well-nigh a century since Wordsworth lamented the decay of "plain living and high thinking." Have the succeeding years brought any improvement in this respect? It is much to be feared they have not. Wealth is, if possible, more than ever the ideal of society, and plain living is terribly at a discount.

We believe, however, that in the deliberate choice of plain living by an influential portion of society there lies a greater potency of social reform than in all the schemes of socialistic reconstruction. The most hurtful thing in the world to-day is the false glamour of wealth. It is against this evil influence that we want an insurrection, not against capital as such. Weaken the fascination of wealth, and, in the same degree that you do so, you increase the moral responsibility of those who are its possessors. The luxury of the present age has run to a dangerous extreme. Advice in such a matter may seem idle, but the discovery that Candide made is one that the world at large must make some day. True happiness is the natural accompaniment of honest industry and moderate living. Such conditions make high thinking possible, and give a savor to all enjoyments. There have been times when men, to save their souls, would go forth into the wilderness or the desert. Such sacrifices are not needed in the present day; there is a very respectable measure of salvation to be won in cultivating a garden.

THE TROUBLES OF ORTHODOXY.

The thought of the age has now reached a point of development at which it has become almost impossible for any man of trained intellect to say that he receives on authority pure and simple any statement which admits or should admit of direct verification—for example, any statement dealing with matters of a historical or scientific character. This, if we mistake not, is the true secret of the troubles over doctrinal questions which have lately broken out in more than one division of the Christian Church. It is not so much that there has been a revolt against doctrines as such, as that a need is felt by thinking and cultivated men to seek for higher grounds of belief than those hitherto deemed sufficient. This has led to a certain generalization of belief, if we may so call it, which to less cultivated minds looks almost like an abandonment of the most essential doctrines of the Christian faith. Such a view of the matter, however, we hold to be entirely erroneous. The men we are thinking of—and Dr. Briggs and Bishop Potter may be taken as conspicuous examples—have the interests of religion and of their fellowmen at heart. They do not wish to force upon others a mode of looking at religious questions for which they are not prepared; but, for their own part, they find it necessary to restate the articles of their religious faith in terms which do not absolutely conflict with the principles of reason. This rectification of terms is imposed in part by the conditions of thought in the modern world, but to an equal extent at least by what may be called an inward expansion of the doctrines themselves. Who that holds any truth, scientific or other, does not feel impelled to seek for it continually a wider interpretation and application? Not otherwise is it, we hold, with religious doctrines; they have their own law of growth and development, and he who would arrest the process condemns them to atrophy and decay.

It is charged against both the scholars we have mentioned that they speak of the Bible as literature, and say that in determining its meaning we must keep in view the same class of considerations which would guide us in dealing with other literary monuments. There is nothing in this which need alarm any thoughtful person. It would be doing less than justice to the Bible to deny that many parts of it are literature of a very high order; and it would be doing less than justice to our own intellects to deny that the conception of the Bible as literature is a great help to its correct interpretation. Religion, in the view of such men as we have mentioned, does not depend upon the meaning given to a text or the acceptance or rejection of any specific statement of fact. There is nothing specially "religious" in believing that the Epistle to the Hebrews was written by St. Paul, or that the adventures of Jonah were precisely as described in the book that bears his name. Grant that the organ of religious apprehension is faith, yet each age must settle for itself the question as to what is the proper scope of faith and what of reason. In the present day reason can deal with many things which at one time were thought to be entirely within the domain of faith, and it would be rash to say that the frontier has even yet received its final rectification. If we rightly understand the position of Dr. Briggs and Bishop Potter, they hold that religion is essentially an attitude of mind and heart, a seeing of the invisible, an instinctive recognition of a supreme moral authority, a sense that every human being is called to nothing less than holiness of life. They reverence the Scriptures because in them, as in no other body of writings in the world, the realities of religion are both expressed and implied. They do not demand of the Bible perfect agreement with either scientific or historic truth; they are content if they find in it the spiritual basis of human life, a scheme of thought that links the individual human being with an infinite origin and an infinite destiny. From their standpoint the value of the Bible for the highest moral purposes would in no way be increased if every word in it which touches on scientific or historical questions had the seal of all the academies in the Old World and the New.

It is not a difficult thing, nor does it require much wisdom, to harry a man whose independent thinking and moral earnestness have forced him to take a different attitude toward some great question from that which is adopted by the multitude. It is easy to present his views in an invidious light, but a more useful task would be to show that all that is essential and precious in religious belief can exist as well in a philosophical as in a popular form. With such a thesis it may not be quite so easy to "score," but it is a pity when the standards of the reporters' room invade the desk of the literary or theological editor. It is upon such men as we have mentioned, men of competent scolarship and earnest spirit, that the task is laid of purifying and liberating the religious consciousness of the age; and we do not hesitate to say that when, from the vantage height of modern knowledge, they affirm with deep conviction the indestructibleness of the religious sentiment and the everlasting reality of its object, they render a service which, from a religious point of view, can not be overestimated.

Scientific Literature.

SPECIAL BOOKS.

In a stout volume* of nearly a thousand pages Mr. *Jackson*, the leader of the Jackson-Harmsworth Polar Expedition of 1894–'97, puts into permanent form the record of three years' observations made in Franz-Josef Land, a region beyond the eightieth parallel of latitude, which was accidentally made known to the world twenty years before by the drift of the Tegethoff, the ill-fated vessel of the Austrian expedition of Payer and Weyprecht. As such it is a substantial contribution to arctic literature, and from it much important detail will be obtained by those seeking further adventure in the quest for the pole, and a mass of material, geographic and otherwise, pertaining to the region which forms the subject of the work before us. The meteorological data, covering as they do a longer continuous period of observation in the extreme North than has heretofore been possible, and fittingly supplementing those recorded by Nansen for an almost equal period, will be specially prized by the scientist, even if the facts of the air are not considered to be the main object of arctic

* A Thousand Days in the Arctic. By Frederick G. Jackson, Knight, First Class, of the Royal Order of St. Olaf, etc. New York and London: Harper & Brothers, 1899.

research. It is interesting to note, from the observations on temperature, that the lowest record was only $-46°$ F., the extreme rigor, consequently, being only that of Dakota or Manitoba, and marking nearly fifty degrees above what has been observed a thousand miles farther to the south at Verkhoyansk, in Siberia. Nothing approaching the extreme cold ($-72°$) noted by Kane and by the Nares British Expedition of 1875–'76 has thus been recorded by Nansen, Peary, or Jackson.

Mr. Jackson's claims to discovery lie mainly in the field of geography; for, while the observations on zoölogy, botany, and geology are by no means meager or lacking in originality, the results obtained have been largely anticipated by other investigators—notably Payer, Leigh Smith, and Nansen. In the domain of geography, however, there is a distinct contribution, and the author has missed no opportunity to add to the catalogue of geographical names by "rounding up," as it were, the numerous points which appeared new to him or were thought worthy of designation. This diligence in applying names, at times to points or places which are wholly insignificant and which could be followed with equal advantage or disadvantage on most of the known coast lines of either Europe or North America, can hardly be said to detract from the value of the discoveries actually made, although their publication, from advance letters received by Mr. Harmsworth's representative in London, has caused hostile comment and bitter controversy, even on the part of British geographers and scientists. Much of Mr. Jackson's work, it was contended, was directed to demolishing the work of Lieutenant Payer in the same region, and toward substituting names for those given, whether with a correct placing or not, by the Austrian commander—in itself a legitimate undertaking, but heralded out, it was claimed, to mask Mr. Jackson's own failure to accomplish the real task of his expedition—the finding of the north pole. Mr. Jackson has certainly very largely remodeled Payer's map of the archipelago, but the new map in no way discredits the attainments of his predecessor, even though showing up many and even glaring inaccuracies in the cartographical details published by him, for allowance must be made for the limitations under which the Austrian commander made his work. The vital points which have to be eliminated from the geography of Payer are: That Franz-Josef Land is a congeries of no very large islands, without continental extent northward, and that much that has been represented to be land is, in fact, water or ice, the appearance of land in the frozen North being frequently suggested by the vast gray and ill-defined ice masses which loom up in fog and mist, both as flat sheets and mountain buttresses.

It was the failure to find a northward continental extension to Franz-Josef Land, such as had been thought to possibly exist by Payer, which led Jackson to abandon all effort to advance upon the pole—a condition which appears, at this time, the more surprising seeing that two expeditions, those of Walter Wellmann and the Duke of Abruzzi, with all of Mr. Jackson's facts before them, have elected this same route as the one most calculated to bring about a successful issue, and certainly much can be said in favor of it. While the Franz-Josef Land route may not commend itself as the one best to be followed—and surely the open highway which from time to time appears north of Spitzbergen offers marked advantages for one without a land following—it still has its advantages in the point of high northern departure, and arctic authorities will fail to be impressed by the negative conditions which were obtained from it by the Harmsworth Expedition. Manifestly, Mr. Jackson had prepared himself for one form of journey only—that of following the land, a singularly blind limitation, considered in the light of the little that was positively known of such land extension as the expedition had counted upon, and one that is disagreeably emphasized by the lavish expenditure of money that had been put to the expedition, and the personal confidence that had in some quarters been expressed in its success. Without wishing in any way to disparage or minimize the importance of Mr. Jackson's work, or to underestimate the hardships of any form of arctic exploration, one can not but feel surprised and in a measure disappointed that an expedition designed primarily for an advance upon the pole, which passed the better part of three years beyond the eightieth parallel of latitude, and whose members during this time did not know a single day of sickness—an almost unprecedented performance in arctic methods—should have found itself in a condition unable even to make an effort upon the "open." The recollection of Parry's performance in the frozen sea north of Spitzbergen in 1827, of Markham's advance in 1876, and of Peary's "treck" across the north of Greenland in 1892, emphasizes only more deeply this feeling of disappointment.

Mr. Jackson has made a very careful study of Franz-Josef Land, and has brought that region into a condition of knowledge similar to that which the different Peary expeditions have brought to the north of Greenland. His narrative is simple and direct, virtually a transcript of notebook and diary, without embellishment of any kind, and with a statement of facts and conditions such as they appeared almost at the instant of time of their occurrence. While indisputably impressing a truthfulness and reality, it can not be said that this method adds to the readableness of the book, which is overburdened with repetitions, frequently in identical words and sentences, to a useless and, one is tempted to say, most distressing extent. It is to be regretted that an explorer of the marked energy, routine, and persistence which are Mr. Jackson's qualities should have faltered in what by some travelers has been considered the most arduous part of their task—the proper preparation of a report—for surely it can not be conceived that a good purpose was subserved, either in a popular or scientific aspect, in the publication of wholly unimportant matter, over and over repeated, merely because it formed part of an official diary. The work is abundantly illustrated throughout with half-tone reproductions from photographs, taken by Jackson and his companions, that give a vivid reality to the journey which no amount of word-painting, even when so skillfully handled as by the present author, could prove a substitute for. Scientists will be gratified to know that supplemental reports, prepared by specialists in different departments, may be expected before long to fill out the full scientific aspects of the exploration.

On one point in connection with Mr. Jackson's discoveries the geographer, not less than the lay public, has the right to break straws with the author—that is, the method of naming the new points of land, water, and ice. Zoölogists and botanists have long been guilty of an absurd levity in the discharge of their obligations as namers of new species, and have burdened the vocabulary of animal and vegetable names with thousands of *personalia* which in no way called for perpetuation, and many of which were suggested only by way of ridicule or jest. So long, however, as these were dressed in Latin or Greek form and remained merely the possession of the scientific world there was little to complain of, and even the objections of the extreme sentimentalists might have been met by an appeal to the difficulty of obtaining or coining judicious or otherwise appropriate names. The case is different with the naming of places on the earth's surface, which at this day can be done with direct reference to euphony, to a certain appropriateness of dedication or appeal, and the intelligence of the student. A map of the world is intended for everybody, and not for a class of specialists, and its symbols are devised for readers of all classes. Maps of America have particularly suffered from irrelevant and commonplace designations, and only during recent years has the money value of names suggested radical changes, as in the case of many of the seaside resorts of the middle Atlantic coast. But, with all our indifferences and extravagances of even a half century ago—the period of Hog Hollows and Yuba Dams—a no cruder infraction of the logic of nomenclature can be found than in the coining of such names as "Cape Mary Harmsworth," "Cape Cecil Harmsworth," "Alfred Harmsworth Island," "Harold Harmsworth Straits," "Cape William Bruce," "Bruce Island," "Mabel [Bruce] Islands," "Mabel Bruce Fjord," "Albert Armitage Island," "Cape Alice Armitage," "Ceceil Rhodes Straits," "H. M. S. Worcester Glacier," etc. These have not even the advantage of an old-time arctic "ring" about them. Courting popularity by the bestowal of all manner of personal names, irrespective of direct relation to the expedition or to geographical exploration, is hardly commendable, and is only less objectionable than the plan suggested a few years ago by an American would-be arctic explorer to "sell" the names of places to be discovered to the highest bidder—i. e., according to a graded schedule of contributions to the expedition funds.

GENERAL NOTICES.

On the South African Frontier * is a narrative of the experiences and observations of the author, Mr. *William Harvey Brown*, partly as naturalist of the United States Government Eclipse-observing Expedition of 1889 to the west coast of Africa, and partly as a resident in various occupations for seven years in Rhodesia. The principal object in composing it was to give American readers a clearer idea of English operations in conquest and colonization on the South African frontier than it is possible to glean from current fragmentary accounts. The author served his apprenticeship at natural history collecting under Prof. L. L. Dyche, of the University of Kansas, and Mr. W. T. Hornady, of the New York Zoölogical Gardens, and was recommended by Mr. Hornady to the Government for the Eclipse Expedition. He sailed first to Freetown, then to St. Paul de Loanda, where he spent a few weeks collecting, establishing his headquarters at Bishop Taylor's American Methodist Self-supporting Mission. Thence, after a short attack of African fever, he proceeded to Cape Town, where he was attacked by the other sort of African fever—"an irresistible longing to penetrate the Dark Continent for purposes of exploration and of observing both man and Nature." He made the journey overland to Mafeting and to the Mashona country, in the region of which he spent seven years as "game-hunter, gold-seeker, landowner, citizen, and soldier," observing and participating in the settlement and early development of the new state of Rhodesia. The larger part of the book is devoted to his adventures and observations, "travel, collecting, hunting, prospecting, farming, scouting, fighting," and seeing pioneer life. Two chapters are devoted to ethnology. The race problems which arise during the stage of transition from barbarism, the agricultural and mineral resources of Rhodesia, and its prospects and possibilities, are discussed.

* On the South African Frontier. The Adventures and Observations of an American in Mashonaland and Matabeleland. New York: Charles Scribner's Sons. Pp. 430, with map. Price, $3.

A very handsome book, in what to many are the most graceful and interesting forms of vegetable life, is Mrs. *Par-*

*sons's How to Know the Ferns.** The name of the author is new, but the author herself is a familiar friend to all lovers of American field and wild-wood life, for she is none other than Mrs. William Starr Dana, who had already given us How to Know the Wild Flowers and According to Season. In this book she does as she did with regard to the wild flowers—takes her readers to the haunts of the ferns and into their company, introduces us to them, and before she is done makes us well acquainted with them. "It seems strange," she says, "that the abundance of ferns everywhere has not aroused more curiosity as to their names, haunts, and habits." Possibly it is because they are so common that we are not at pains to seek greater intimacy with them. Then, they depend on the beauty of graceful proportion, which is less obvious to careless eyes than that of color. First, Mrs. Parsons discourses of Ferns as a Hobby, and the pleasure we may derive from them; then she tells when and where to find them, defines the terms used in speaking of them, explains their fertilization, development, and fructification, gives a list of notable fern families and descriptions of the American ferns classified into eight groups according to the arrangement of their spores, and completes the work with indexes of Latin and of English names and of technical terms.

The Microscopy of Drinking Water † is intended by Mr. *Whipple* primarily to serve as a guide to the water analyst and the water-works engineer by describing the methods of microscopic examination, assisting in the identification of the common microscopic organisms found in drinking water, and interpreting the results in the light of environmental studies. A second purpose is to stimulate a greater interest in the study of microscopic aquatic life and general limnology (the lessons of lakes and ponds) from the practical and economic point of view. The work is elementary in character. Principles are stated and illustrated, but the last ten years' accumulations of data are not otherwise attacked. The illustrations have been largely drawn from Massachusetts cases, from which there may be differences elsewhere, but not very great as to microscopic organisms. The latter half of the book is devoted to descriptions of a limited number of organisms, chosen for the most part from those commonest to the water supplies of New England, and those that have best illustrated the more important groups of microscopic animals and plants. Most of the illustrations have been drawn from living specimens or photomicrographs of such, but some are reproduced from other sources.

It is evidence of appreciation of Dr. *Wetterstrand's Hypnotism and its Application to Medicine* * that, written in Swedish, it has been translated into German and Russian, and now into English. The German work, from which the present translation is made, was enlarged from the original, and embodied the results of additional experience. The author disavows the intention of writing a manual or text-book, and modestly assumes only to have given "unpretentious notes by a physician who, under the pressure of a fatiguing and engrossing practice, has not been able to develop his rich material into a more complete form." The book is characterized by the translator as more practical than theoretical, and as offering the results of conscientious and able observation. Hypnosis is defined by Dr. Wetterstrand as embracing a number of various conditions of the nervous system, which can be produced in different ways. "We recognize phases of the greatest variety, from a slight heaviness in the limbs, the most superficial somnolence enabling the hypnotized subject to hear and perceive the least noise, to the deepest sleep, from which the greatest disturbance can not awake him, and wherein every sensation disappears and permits the most serious surgical operation without pain." The author believes that the majority of people can be brought into any of these

* How to Know the Ferns. A Guide to the Names, Haunts, and Habits of our Common Ferns. By Frances Theodora Parsons. New York: Charles Scribner's Sons. Pp. 215. Price, $1.50.

† The Microscopy of Drinking Water. By George Chandler Whipple. New York: John Wiley & Sons. Pp. 300, with nineteen plates.

* Hypnotism and its Application to Medicine. By Otto Georg Wetterstrand, M. D. Authorized translation (from the German edition), by Henrik G. Petersen, M. D. Together with Medical Letters on Hypno-Suggestion, etc. By Henrik G. Petersen, M. D. New York: G. P. Putnam's Sons. Pp. 166.

conditions, but the methods and degrees of difficulty of the process are various. "Liébeault distinguishes five degrees in hypnotic sleep, Bernheim nine; but Wetterstrand thinks they may all be grouped under three. Suggestive therapeutics is regarded as by no means a panacea, but it succeeds in cases where other methods have failed," and, as Bernheim says, "often it produces miracles." After an outline of the general principles of the subject the author passes on to describe some diseases and morbid conditions in which he has employed hypnotism with the greatest results, culling from his notes, as impartially as possible, both successful attempts and failures. The cases include insomnia, the list of nervous diseases, drug diseases, consumption, rheumatic, heart, and other organic diseases, and functional affections; with the use of suggestive therapeutics in operations, obstetrics, and on some other occasions. Dr. Petersen's medical letters on hypno-suggestion, etc., added to Dr. Wetterstrand's work, are intended to give a succinct idea of the present status of practical psychic therapeutics, as based on the observation of clinical facts. They relate to suggestive treatment in reform work, post-hypnotic responsibility, and music in hospitals.

The original object of Mr. *Henry Rutgers Marshall's* essay on *Instinct and Reason* * was to present a conception of religion. In attempting to make his argument convincing he found it necessary to deal with questions which did not at first appear to relate to this subject, whereby the study of religion, though still the most important and interesting matter considered, is made to appear subsidiary to the treatment of instinct and reason. Believing that activities so universal in man as those which express his religious life must be significant in relation to his biological development, the author has attempted to outline a theory that will account for their existence and explain their biological import. In order to present this clearly he has made a special study of instinct and the relation of its activities with religious activities in general. This has naturally led to the study of impulse, and thus to a consideration of moral standards. The study of reason, too, has been found appropriate in connection with the consideration of the nature of religion. The genesis of religious customs and beliefs is touched upon only so far as seems necessary for the elucidation of other parts of the treatise. Concerning the relation of religion and morals, the author finds that religion teaches us to listen to the past, and gives enthusiasm to do the work commended by the "voice" of that past; it gives us the basis for the perfection of our moral code, but it does not give us this perfect moral code itself. When reason and the religious instinct are opposed we should, after reverent and full consideration, act in accord with reason, but should be cautious in guiding others that way, for the chances are decidedly that we are wrong, and "the rule of action which will best satisfy conscience, which will produce the closest correspondence between our action as viewed in retrospect and our most permanently efficient impulse series, is one which is based upon the religious instinct, and which involves the presence in mind of the sense of duty."

* Instinct and Reason. An Essay concerning the Relation of Instinct to Reason, with some Special Study of the Nature of Religion. By Henry Rutgers Marshall. New York: The Macmillan Company. Pp. 574. Price, $3.50.

Mr. *Arthur Berry* has undertaken, in his *Short History of Astronomy*,* to give an outline of the history of the science from the earliest times in a form intelligible to readers who have no special knowledge of astronomy or mathematics. Some compression having been necessary, it has been found possible to omit a considerable number of details which might receive treatment, and indeed would often require it in a treatise on the science. The author has deliberately abstained from giving any connected account of the astronomy of the Egyptians, Chaldeans, Chinese, and other peoples who are usually supposed to have had a share in the early development of star-lore. Accounts of scientific instruments, except in a few simple and important cases, are omitted. But little is said of scientific discoveries that have to be described in technical mathematical language, and of speculative theories that have not been established or

* A Short History of Astronomy. By Arthur Berry. New York: Charles Scribner's Sons. (The University Series.) Pp. 440. Price, $1.50.

refuted. On the other hand, whatever pertains to the real history of astronomy has been given with sufficient fullness to make it plain; the principles which are illustrated by enormous masses of observations that there is no room to record; short biographical sketches of leading astronomers other than living ones; a considerable number of dates, such as those of the births and deaths of astronomers; and even descriptions of such obsolete theories as appear to form an integral part of astronomical progress. Among the illustrations are portraits of a few of the eminent astronomers of the past.

The special articles in the *Bulletin of the Department of Labor*, Nos. 18 and 19, are Wages in the United States and Europe, 1870 to 1898, in the September number, and Mr. Dunham's paper on The Alaskan Gold Fields and the Opportunities they offer for Capital and Labor, and Mutual Relief and Benefit Associations in the Printing Trade, by W. S. Wandly, in the number for November.

The Rev. Dr. *Adam Miller* is a retired minister who has devoted his leisure hours to the study of sunshine, in which he has included all that properly belongs to the sun. He has read the standard works on astronomy, and some, but apparently not all, the later results for comparison, it seems, rather than information, and he has performed some original and ingenious experiments with the sunlight. His views, therefore, as expressed in *The Sun an Electric Light* (Chicago), are his own. He has come to the conclusion that the material theories of the origin of the sun's light and heat do not account for the facts, and are therefore insufficient if not wrong; postulates a theory that the phenomena are matters of electric action made perceptible to us by refraction through the atmosphere, and makes an unnecessary and inconsequent attack on the theory of the conservation of forces. When Dr. Miller assumes that his views of the insufficiency of present theories and of the electrical nature of the sun's action are new, he shows that he is not fully read up in the current literature on the subject. The insufficiency of present views is confessed, and the discussions of the subject with the various suppositions which he criticises are efforts to find better explanations. The causal identity of electricity, heat, and certain other forces is accepted. But, given that electrical action is the basis of it all, what then? Philosophers know of no way of maintaining electric action except through material processes, and the way they are replenished to keep it up is as hard to find out as would be the way fuel is supplied to keep up a solar fire.

A pamphlet entitled *The Story of the Rise of the Oral Method in America* (of Instructing the Deaf and Dumb) *as told in the Writings of the late Hon. Gardner G. Hubbard*, compiled by Mrs. *M. Gardner Bell*, reveals a seeming indolence in the early instructors of the old method that is hardly creditable to their energy in investigation. When deaf-mute instruction was first projected here, a teacher was sent over to Europe to learn the best methods. Denied access to schools in London and Edinburgh, where articulation systems were taught, he went to Paris, found the Abbé de l'Epée's sign language there and brought it over. This and the finger language held sway in our schools for many years, while the possibility of teaching articulation to the deaf was denied. It required long-persistent effort on the part of a few men who refused to have their deaf children taught these systems and consequently isolated from their fellow-men to secure a recognized place for oral schools. The story of the struggle is told in Mrs. Bell's pamphlet.

The widespread ignorance and superstition with which even to-day the practicing physician has to contend are hardly conceivable by an outsider. The conditions under which a doctor knows his patients are just those calculated to bring out the weak spots in their mental organization, and the absurd notions which still have a foothold in many minds are a constant source of wonder to the speculative doctor. These superstitions are so widespread and so frequently dangerous to the whole community, as well as the individual himself, that anything which is calculated to improve matters, however so little, should be welcomed with open arms. *Dr. Therne*, by *H. Rider Haggard*, is aimed at the antivaccinators, and by means of a not uninteresting story points out the serious consequences which a general belief in this absurd crusade brought to an English city. The author labels his story as an attempt to forecast the "almost certain issue of the recent surrender of the English Government leaders to the clamor of the antivaccinationists."

The annual number of the *Cumulative Index* for 1898, constituting the third annual volume, is a book of seven hundred and ninety-two pages, and includes one hundred periodicals. It indexes—by authors, titles, and subjects, including reviews and portraits—what is important in the monthly and part of that in the weekly publications of the year. Special attention is given to portraits, reviews, and necrology. The Index is a very useful publication to writers and students of every sort, recording the articles as they appear month by month in a form that makes the knowledge of them easily accessible to one who seeks it. The numbers succeeding the first number of the volume include, besides their own fresh matter, that which has appeared in two or three previous numbers, saving the necessity of hunting up scattered editions. The annual volume contains all for the year. The Index is edited in the Public Library of Cleveland, Ohio, and is published by the Holman-Taylor Company in the same city.

Two papers bearing upon instruction of the deaf, published by the Volta Bureau, Washington, are statistics, by Alexander G. Bell, of the relative use in the United States of the several methods, and a collection of *International Reports of Schools for the Deaf*. The latter paper contains reports from sixteen countries.

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Fragments of Science.

Death of Dr. Brinton.—By the death of Dr. Daniel G. Brinton, at Atlantic City, N. J., July 31st, America loses one of the most industrious and intelligent students of its ethnology, languages, and antiquities. We think we may safely say of him that he did as much as any other single man among us to organize and systematize these studies and put them on a stable foundation and a broad basis. To them he devoted his time, his heart, and his fortune. Dr. Brinton was born in West Chester, Pa., in 1837; was a graduate of Yale College and of Jefferson Medical College; served in medical departments in the United States Volunteer Army during the civil war; was for several years editor of the Medical and Surgical Reporter and of the Quarterly Compendium of Medical Science; and was finally drawn predominantly to the study of American ethnology and languages, to which he contributed a long list of books, special articles, and paragraphs, a large proportion of them fruits of his own investigations. For his work in this department he received, in 1866, the medal of the Société Américaine de France. He was Professor of Ethnology and Archæology in the Academy of Natural Sciences of Philadelphia, and of American Linguistics and Archæology in the University of Pennsylvania, and was President of the Antiquarian and Numismatic Society of Philadelphia. He was President of the American Association for the Advancement of Science in 1894. He established a library and publishing house of aboriginal American literature, and one of his most noteworthy works was the publication in this library of a series of original texts in the languages of North and South American tribes, with commentaries and translations, in the preparation of which he called in other Americanists to assist him. In this way he contributed much to save a literature and a history that were fast disappearing. A few months ago, as was mentioned in the Monthly at the time, he presented his entire collection of books, pamphlets, and manuscripts, many original and some unique, relating to the aboriginal languages of North and South America, to the University of Pennsylvania.

Nebraska as a Home for Birds.—Mr. Lawrence Bruner introduces his Notes on Nebraska Birds with the expression of a belief, founded on his own observations for twenty-five years, together with those of about fifty other persons to whose notes he has had access, that Nebraska, although a prairie State, has an unusually large bird fauna. The notes show 415 species and subspecies as visiting the State, while there are records of 227 species breeding within its borders, and of more than 700 winter residents. "When we learn that only about 780 species are recorded for the whole of North America north of the Mexican boundary, it certainly seems astonishing that from among them we should receive so large a percentage. If, however, we take into consideration the variations in altitude above sea level, the differences in surface configuration, climate, etc., that pertain to our State, its location, and the relation which it bears to the country at large, perhaps the wonderment will become less." The southeastern corner of Nebraska is only eight hundred feet, the western border almost six thousand feet, above tide water. The State is divided into timber, prairie, and plain regions. It lies in the middle of the United States, with a high mountain chain to the west and a giant water way along its eastern boundary. In fact, eastern, western, northern, and southern fauna meet in Nebraska, and it also has a fauna of its own. Forms are found there that belong to low and high altitudes, to wet and dry climates, to prairie and timbered countries, and to semi-desert and alkali regions.

The Power of the Imagination.—The following interesting experiment is described in the Psychological Review for July by E. E. Slosson, of the University of Wyoming: "I had prepared a bottle, filled with distilled water, carefully wrapped in cotton and packed in a box. After some other experiments in the course of a popular lecture I stated that I wished to see how rapidly an odor would be diffused through the air, and requested that as soon as any one perceived the odor he should raise his hand. I then unpacked the bottle in the front of the hall, poured the water over the cotton, holding my head away during the operation, and started a stop-watch while awaiting results. I explained that I was quite sure no one in the audience had ever smelled the chemical compound which I had poured out, and expressed the hope that while they might find the odor strong and peculiar it would not be disagreeable to any one. In fifteen seconds most of those in the front row had raised their hands, and in forty seconds the 'odor' had spread to the back of the hall, keeping a pretty regular 'wave front' as it passed on. About three quarters of the audience claimed to perceive the smell, the obstinate minority including more men than the average of the whole. More would probably have succumbed to the suggestion, but at the end of a minute I was obliged to stop the experiment, for some on the front seats were being unpleasantly affected, and were about to leave the room."

Government Scientific Work.—Mr. Charles W. Dabney, Jr., of Knoxville, Tenn., while having a very high opinion of the scientific work of the Government, finds it greatly scattered and confused, and often multiplied, among the departments. There are three distinct and seperate agencies for measuring the land of the country, four hydrographic offices in as many departments, and five separate and distinct Government chemical laboratories. The Coast Survey, the Naval Observatory, and the Weather Bureau are all engaged in studying the magnetism of the earth. Three distinct branches of the Interior Department are engaged in irrigation work, and the census has published a report on the subject, while the report of a board appointed to examine into the matter shows that eight bureaus of the Interior and Agriculture Departments must co-operate in order to accomplish any thorough work on the great problem of irrigation. The statistics of the natural resources and the products of the country, of exports and imports, of populations, schools, etc., are collected and compiled by eight or ten different agencies in five or six different departments. Mr. Dabney's remedy for this condition is the consolidation of all the scientific work under a single department, to constitute a National Department of Science. This seems hardly necessary. The scientific work of the departments has grown under the pressure of their necessities, relating chiefly to the examination of an unsettled and unexplored country. So long and so far as such work is essential to the legitimate work of the department it will have to be done within it. All work beyond this can be left to the Smithsonian Institution, the universities and scientific academies, and individual effort. The Government of the United States is not a scientific body.

American Indians and Mongolians.—In answer to Major Powell's theory, recently expressed anew, that while there may be a unity of species in the ancient physical man, the civilization, arts, industries, institutions, languages, and opinions of the American tribes were autochthonous, and owed nothing to Old-World influences; Mr. James Wickersham, of Tacoma, Washington, maintains that our Indians are connected in blood with the Mongolian stock of East Asia and none other, and that their arts, etc., were derived thence in comparatively recent times. In the comparison he makes, for argument, between the two races he finds a considerable number of features that were common and peculiar to both. Of both, the Chino-Japanese and the Americans, he says: "The most civilized tribes spoke a monosyllabic language, others spoke an agglutinative tongue; their writing was ideographic and written from right to left, from top to bottom; their systems of numeration were based upon the digital count, and their old numerals up to nineteen were practically identical; their calendar systems were alike in principle, and nearly so in details; both divided time into cycles and quarters thereof; the solar year in both regions began at the winter solstice, and the solstices were celebrated in both lands on the same day by the same national festivals; both prepared almanacs on paper of national manufacture; the good or evil power of every day was fixed by the priest-astronomer, and each almanac also contained medical receipts and astrological formulæ and a table of religious festivals; the same elements, colors, viscera, birds, seasons, and planets were assigned in the same general scheme to the cardinal points." Like similarities are traced in constitutions, laws, ecclesiastical institutions, monastic orders, and physical aspects.

The Teaching of Bows and Arrows.—What the study of so simple a subject as bows and arrows may reveal is illustrated by Mr. Herman Meyer's paper in the Smithsonian Report for 1896 on Bows and Arrows in Central Brazil; an introduction giving a general outline of a contemplated larger work which intended to set forth for the circumscribed region of the Matto-Grosso, how, through the harmonizing of different tribal groups, ethnographic types arise; what share the several associated tribes have had in this creation of groups; and, on the other hand, what ethnographic development within the group each tribe has undergone. While the South American Indian tribes have different special methods of capturing wild animals, they all have as the chief weapon the bow and arrow, which even the gun can not supplant. The tribes that are now sedentary, which practice hunting along with agriculture only for amusement, exercise still the greatest care upon the preparation of this weapon, and know how to use it with skill. In their sagas the bow and arrow still play an important part. They are regarded almost as sacred, and are frequently used as cult objects. When bows and arrows are exchanged for other weapons the children keep up the old reminiscences, and hold on to the bow and arrow as playthings. The South American Indian is accustomed to recognize the tribe by its arrow. A grouping by these weapons, a separation of forms according to specific marks of structure, is possible for the study of the tribes. The feathering, which seems to be capable of unlimited variation, is of great importance. A great deal of care may be bestowed on the fastening of the feather, on the wrapping of the shaft with thread, or upon the manner of fitting the feather. The wrapping of the feathered end or shaftment offers excellent opportunity to preserve certain textile patterns, perhaps the one remaining survival of the old tribal peculiarity. The fastening of the point to the shaft or to the foreshaft also affords a safe datum for discriminating, and the shape of the point furnishes a guide for differentiations.

An Aztec Pictorial Record.—The forty-four paintings of the *Mapa de Cuauhtlantzinco* were executed in oil colors on European paper by an artist named Tepozetecatl, and are of high importance in the history of the conquest of Mexico. The Pueblo of San Juan de Cuauhtlantzinco, to which they belong, is situated between the cities of Pueblo and Cholula, and is inhabited by about fifteen hundred people, who still speak the Aztec language. The pictures, each about sixteen by twelve inches in size, were discovered about thirty years ago by Padre D. José Vicente Campos, who, to save them from decay, had them pasted on cotton sheeting and mounted in two frames. They contain scenes from the conquest—not badly executed—and portraits of aborigines. Each bears a text in Nahuatl, which Padre Campos translated into Spanish and appended the translation to the original. Another series of ancient paintings somewhat like these was preserved for a long time at Tlaxcala, but, according to Prof. Frederick Starr, they were less personal and less local. They are called the *Lienzo de Tlaxcala,* and picture all the important events of conquest from the time when Cortes came into contact with the Tlascalans till the city of Mexico was captured. The Mapa de Cuauhtlantzinco deals with but little space; perhaps Texculco and Chalco and Quimistlan describe its limits. The pictures and the texts in Spanish and English have been copied by Professor Starr, who publishes them for their ethnological interest, in that they illustrate a practice, common at the time of the conquest, of painting representations of important matters; that they in many cases present successful portraits; that they are, in conception and execution, truly native works of art; that they give considerable information relative to daily life and customs; and that they are psychically interesting in showing the feelings of the natives shortly after the conquest toward their conquerors and toward the newly introduced religion. The town of Cuauhtlantzinco appears to have been settled between 1519 and 1528 by refugees from Cholula, who were driven away because they had gone to Tlaxcala to visit Cortes and invite him to come to their pueblo.

Permanence of the Fish Supply.—A Scottish fish commission has been for fifteen years conducting an experimental research on the capacity of the sea to bear the drain upon its resources made by the growing industry of trawl fishing along shore. Some first-class fishing grounds along the coast were closed for several years, in the anticipation that the fish, freed from molestation, would breed and multiply in them. The conclusion reached from examination of the results has been that fishing or no fishing makes no difference whatever. "On the preserved grounds there are no more fish, and no less, than when the trawls were daily dragged across the bottoms of the bays. For the rest of the areas frequented by trawlers beyond the three-mile limit the happy conclusion is that there are as many fish in the sea as ever, and that the supply does not diminish, in spite of the increased and increasing number of ships engaged in the fisheries and their fine equipment." The equipment of steam trawlers for the North Sea and the open ocean has become an immense industry in the east of England. Never have so much capital and labor been spent in harrying the fish since the fishing began. "Yet the take steadily increases as the boats increase. 'The great labor and expenditure of the last ten years prove that the balance of Nature in the neighboring seas is steadily maintained, and that there is no need for anxiety concerning the continuance of every species of good fish.' . . . It is now clear that life in the sea is not dependent on what takes place near the shore. In other words, it is difficult to destroy marine life, so far as fish are concerned, by mischief done near the coast. Their area of propagation and reproduction is too large for land creatures like us, who can only invade the sea in boats, seriously to injure it." Yet the experiments and experience of the United States Fish Commission show that we are able to increase the supply immensely.

Relative Power of Fungicides.—Mr. F. L. Stevens has published, in the Botanical Gazette, an account of experiments made for the purpose of establishing with some degree of accuracy the strengths of various solutions which are necessary to prevent the growth of fungous spores. The bearing of this question upon the relation of a fungicide to its efficiency is apparent. As among the general results the author finds that mercuric chloride is the strongest chemical used in its toxic effect upon the fungi, while potassium cyanide is remarkably weak considering its great toxic action on animals. Alcohol and sodium chloride have a stimulating effect. Various fungi offer different resistance to poisons, and the limits of resistance will vary in the same species. The spores of fungi are less susceptible than the roots of seedlings. A chemical may be twice as powerful as another against one fungus, while in acting upon another fungus an entirely different ratio may be sustained. An occasional spore may germinate and grow quite normally in a solution that prevents hundreds of normal spores around it from germinating. Penicillium as a nutrient medium offered greater resistance to poisons than did any of the other fungi worked upon. Uromyces did not diminish in vigor of growth with the increased strength of the poison, but the percentage of spores that germinated was diminished. In general, the results of the action of the chemicals were in accord with the theory of hydrolytic association. Incidentally new evidence bearing upon the theory of the hydrolytic dissociation of the molecule was adduced, together with facts that may throw some light upon the structure of the cell wall.

National Forest Reserves.—The report of the Secretary of the Interior for the year ending June 30, 1898, mentions thirty forest reservations (exclusive of the Afognac Forest and Fish-Culture Reserve in Alaska) as existing by presidential proclamation under the act of March 3, 1891, embracing an estimated area of 40,719,474 acres. The patrolling of the reserves has shown that fire is the paramount danger to which they are exposed. Next to fire, sheep-raising is the most serious difficulty to be considered in administering the reserves. Yet, as it is not considered expedient to prohibit so important an industry throughout the reserves, special efforts have been directed toward ascertaining the particular regions in which the conditions demand the exclusion of sheep, and toward learning what restrictions may be necessary in other regions. The institution of a national system of timber cutting to be economical in all directions is under consideration, but it is acknowledged that the work will require a certain degree of experience and training on the part of forest officers. A forest system inaugurated by the department in August, 1898, in which the reserves are placed under the control of a graded force of officers, has already shown good results; the reports received from the forest officers indicate that the patrolling has limited both the number and extent of fires. During the eighteen months previous to the preparation of the report in November, 1898, a great advance was made toward a comprehensive administration of the public forests. A marked change in public sentiment toward forest policy is noticed, with a subsidence of the opposition to the reserves and a tendency among the people in the localities directly interested to take a deep and approving interest in the matter.

Sloyd as an Educational Factor.—Mr. Gustaf Larsson, of the Sloyd Training School, Boston, represents, in his Bulletin, that Sloyd is steadily gaining ground, and has been introduced, during the past year, into city schools, colleges, and charitable institutions, and that many clubs and social organizations are becoming interested in it as an educational factor. The Sloyd principles seem to meet a cordial welcome wherever they are adequately presented. Mr. Larsson insists that in Sloyd instruction the teacher should enter into the child's point of view, and must never forget, he says, that it is the real work which appeals to him, and not the particular exercise or the typical use of the tool. As Dr. Henderson says, it is not necessary to be forever suggesting to him that he is being educated. "We must see, feel, and think with the worker, and so introduce our disciplinary exercises that he practices them correctly while still carrying out his own dearest desire. In this way only can he get the greatest benefit from any exercise. We must constantly bear in mind that we are aiming at a well-developed producer rather than a perfect product. . . . Whenever a piece of work, however poor in itself, stands for a child's best effort, it is a highly satisfactory production from the true teacher's point of view. He must remember also to keep constantly before us the fact that independence and self-reliance are to be cultivated from the outset." Sloyd claims to be peculiar in aiming at ethical rather than technical results, and at general organic development rather than special skill; in employing only pedagogically trained teachers; in using rationally progressive courses of exercises applied on objects of good form which are also of special use to the worker; in striving after gymnastically correct working positions in encouraging the use of both the left and right sides of the body; and in giving to each individual opportunity to progress according to his peculiar ability. These points have been emphasized in Sloyd from its beginning in Sweden more than twenty-five years ago.

Hawaiian Reptiles.—It is shown, in a paper on the subject by Dr. Leonhard Stejneger, published by the United States National Museum, that there are no true land reptiles in the Hawaiian archipelago other than a few species of lizards, all belonging to the cosmopolitan families—the geckoes (four species) and the skinks (three species). All of these, except one of the geckoes, belong to species widely distributed over the Indo-Polynesian island world, while the gecko excepted has close relatives in New Caledonia, Java, Sumatra, and Ceylon. This distribution is regarded by the author as not sustaining the theory of a once continuous land connection between the various island groups, but rather, by the limited number of species, as indicating that at the time of the immigration of the lizards the islands were separated from other lands. Yet these land creatures could not have been distributed over thousands of miles of ocean by ordinary means, and the agency of man has to be invoked. From various considerations it is permissible to conclude that they came to the islands with the ancestors of the Hawaiians. No records are known of any of the marine snakes having been taken at the Sandwich Islands. Marine turtles live in the seas surrounding the archipelago and breed upon some of its outlying islands, but little is known of them. There are no indigenous batrachians in the group, but frogs and toads are said to have been brought, intentionally, from China, Japan, and America to assist in the fight against mosquitoes.

MINOR PARAGRAPHS.

Miss Kingsley defines one of the fundamental doctrines of African fetich as being that the connection of a certain spirit with a certain mass of matter, a material object, is not permanent. "The African will point out to you a lightning-stricken tree and tell you that its spirit has been killed; he will tell you when the cooking pot has gone to bits that it has lost its spirit; if his weapon fails, it is because some one has stolen or made sick its spirit by means of witchcraft. In every action of his daily life he shows you how he lives with a great, powerful spirit world around him. You will see him, before starting out to hunt or fight, rubbing medicine into his weapons to strengthen the spirit within them, talking the while, telling them what care he has taken of them, reminding them of the gifts he has given them, though those gifts were hard to give, and begging them in the hour of his dire necessity not to fail him. You will see him bending over the face of a river, talking to its spirit with proper incantations, asking it when it meets a man who is an enemy of his to upset his canoe or drown him, or asking it to carry down with it some curse to the village below which has angered him, and in a thousand other ways he shows you what he believes if you will watch him patiently. It is a very important point in the study of pure fetich to gain a clear conception of this arrangement of things in grades. As far as I have gone I think I may say fourteen classes of spirits exist in fetich. Dr. Nassau, of Gaboon, thinks that the spirits affecting human affairs can be classified completely into six classes."

At a recent meeting of the Institute of Mining Engineers (England), reported by Industries and Iron, Mr. J. A. Longden, who delivered the opening address, discussed the problem presented by the rapid exhaustion of the English coal fields. During the last twenty-five years, he said, the output of coal had increased from 120,000,000 to 200,000,000 tons, the ratio of increase being two and a half per cent per annum. Assuming that the increase for the next twenty-five years will only be one and a half per cent, the coal output in 1925 would reach 280,000,000 tons. At such an increasing annual output the commercially workable coal would be practically used up. Mr. Longden suggested the propriety of putting an export duty of sixpence per ton on all coal exported, and finally said: The evidence before them all pointed to one thing—namely, that in fifty years they would practically be dependent on the United States of America for cheap coal, iron, and steel, and when this came about "we or our sons will find out that an alliance with the United States for coaling our navy was imperative." In conclusion, he insisted upon the necessity of taking measures to avoid waste in the coal industry.

The following note is from Nature of May 11th: "At the last meeting of the Anatomical Society of Great Britain and Ireland Dr. Elliot Smith settled a point in the comparative morphology of the brain which at one time was the subject of a heated controversy between Huxley and Owen. In 1861, it may be remembered, Owen maintained that the *calcar avis* and the calcarine fissure which causes it were characters peculiar to the brain of man, a statement which Huxley showed to be untrue, the formation being well marked in all primate brains. Dr. Elliot Smith has reached the further generalization that the *calcar avis* is a character shown by all mammalian brains, with the possible exception of the prototherian. He identifies—and the reasons for this identification do not seem capable of refutation—the calcarine fissure of the primate brain with the splenial fissure of the brain of other mammals. This generalization will materially assist in homologizing the primate and unguiculate *pallium*."

The influence of wind on the speed of steamers is of considerably more importance than is generally believed. In the *Annalen der Hydrographie* for January, 1899, L. E. Dinklage describes some observations recently made on two of the North German Lloyd steamers of about five thousand tons and fifteen or sixteen knots. The results show that when the wind was favorable no difference whatever could be detected in the speed of the vessels during a light breeze or a heavy gale. But with a beam (cross-wind) or head wind a reduction of from three to five knots and a half was produced. The obvious conclusion is that the wind when favorable never helps a fast steamer, but always hinders it when unfavorable. Probably with vessels steaming ten knots or less a favoring gale might increase the speed.

NOTES.

The burden of the president's address of J. B. Johnson before the Society for the Promotion of Engineering Education is the necessity for our future material prosperity for a specific scientific training for the directors of each and every kind of manufacturing and commercial activity. Germany "has worked out this problem to a most fruitful issue," but its imperial and paternal method can not be imitated here, or probably anywhere else. The problem is a very difficult one with us, and it will be of no use to look to municipalities or Legislatures for its solution. There exist a few special high-grade industrial, commercial, mechanical, electrical, and mining schools, but they are entirely inadequate to answer the demands of the occasion. The author looks to organized commercial bodies like the one he is addressing as furnishing the best means for establishing the schools desired.

Prof. F. L. Washburn, of the University of Oregon, describes in the American Naturalist a curious specimen of the toad (*Bufo columbiensis*), which has an extra arm projecting from the left side just in front of the normal left arm. The extra arm has seven digits, and is without an elbow joint, but is slightly movable at the proximal joint next to the body. Its radius and ulna are separate bones, not fused as they are normally. The dissection shows other peculiarities of structure, such as might be expected from a consideration of the exterior. The species, normal, is common in parts of Oregon.

It is related of Charcot, the distinguished alienist, late of the Salpêtrière, Paris, that he had marked artistic ability, and when he was seventeen years old his family had some hesitation whether to make him a doctor or a painter. He chose the medical profession. He was fond of drawing sketches of his patients, and of landscapes he saw in his travels, and was not above making an occasional caricature. Several albums are filled with designs of this kind. A study of his work as an artist was prepared by Dr. Henri Meige in connection with the erection of his monument, and is deposited in the Salpêtrière.

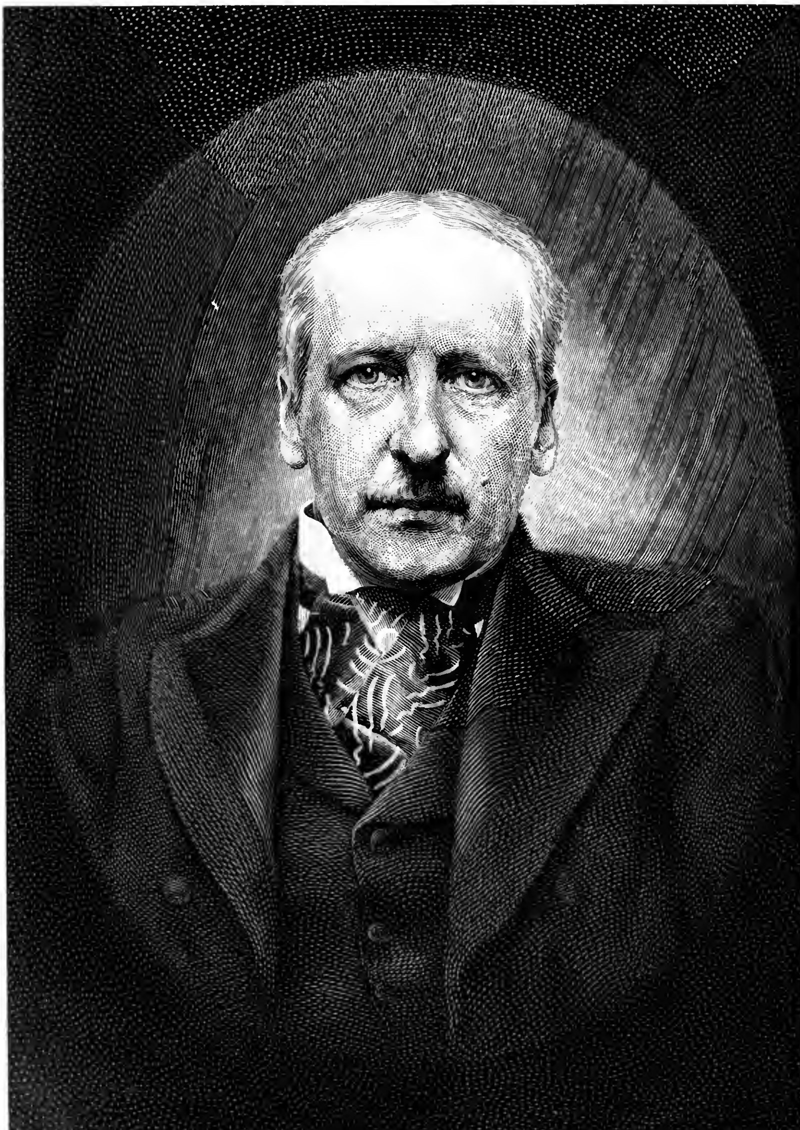
The Russian decree nullifying the constitutional privileges of Finland, notwithstanding treaty guarantees, is producing an effect that was probably not intended or anticipated. Realizing the futility of resistance and holding the people true to their reputation of being the most peaceable, enlightened, and orderly of the Czar's subjects, the representatives of the Finns are said to be quietly making inquiries about the prospects of settlement in the Canadian Northwest and other free regions.

Despite the growing use of motor traction, the raising of horses gives no sign of diminishing. Against 212,827 horses in 1888, the Argentine Republic has, by the census of 1895, 4,234,032. That country now ranks third in horse-rearing nations, being excelled only by Russia and the United States.

M. André Broca has found, concerning the use of India-rubber supports for isolating physical apparatus from earth tremors, that when apparatus having movable parts are supported in this way the vibrations, instead of being reduced, may in some cases be increased tenfold. But when the apparatus consists entirely of rigid material there is no better way of insuring steadiness than by resting it on India rubber.

The Pennsylvania Society for the Prevention of Tuberculosis works for the single end of educating the community in a knowledge of the true nature of consumption and of the means of controlling or conquering it. For this it diffuses literature, seeks the aid of persons in influential positions, and strives to obtain the requisite conditions for restoring those early afflicted and for preventing the communication of infection to others from those far advanced. Its main effort is directed toward the establishment of a municipal hospital for tuberculous patients, and for a sanatorium in the high regions of the State. For the last purpose it is offered a most desirable location in Luzerne County.

The list of recent deaths among men known in science includes the names of W. W. Norman, Professor of Biology in the University of Texas; John Whitehead, who died while on a scientific mission to the island of Hainan, for which he left England in the autumn of 1898; Naval Lieutenant Charles William Baillie, Marine Superintendent of the English Meteorological Office, inventor of the hydra sounding machine, late Director of Nautical Studies at the Imperial Naval College, Tokio, and author of important meteorological investigations, at Broadstairs, June 2th, aged fifty-five years; Henry Wollaston Blake, an original member of the Institution of Civil Engineers, of the Institution of Mechanical Engineers, and of the British Association, and a Fellow of the Royal Society, eighty-four years of age; Edward Jannetaz, a French mineralogist, an assistant in the Museum of Paris, and Lecturer on Mineralogy for forty years, Master of Conferences in the Faculty of Sciences, author of *Les Roches* and other books, aged sixty-seven years; Dr. Eugen Ritter von Lommell, of the University of Munich, distinguished in mathematics, physics, and optics, and author of several books on those subjects, including The Nature of Light in the International Scientific Series, June 19th, in his sixty-third year; Sir Alexander Armstrong, arctic navigator and discoverer of the Northwest passage, late Director-General of the Medical Department of the British Museum, and author of a narrative of his great discovery and of a work on Naval Hygiene; Dr. Hugo Weidel, Professor of Chemistry in the University of Vienna; Sir William Henry Flower, late Director of the British Museum of Natural History, Past President of the British Association, at the time of his death President of the Zoölogical Society of London, and author of several excellent books on zoölogy, natural history, museums, and kindred subjects, aged sixty-eight years; and Dr. Daniel G. Brinton, the distinguished American ethnologist and lingust, of whom we give a fuller notice elsewhere.



WILLIAM PEPPER.

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THE HELP THAT HARMS.

By the Right Reverend HENRY C. POTTER.

THE analogies between the life of an individual and that other organism which we call civilized society are as interesting as for any other reason because of their inexhaustible and ever-fresh variety. The wants, the blunders, the growth, the perils of the individual are matched at every step by those other wants and dangers and developments which rise in complexity and in variety as the individual and the social organism rise in intelligence, in numbers, and in wealth. It ought to interest us, if it never has, to consider from how much that is mischievous and dangerous we should be delivered if we could revert from the civilized to the savage state; and it is undoubtedly true that serious minds have sometimes been tempted to question whether civilization is quite worth all that it has cost us in its manifold departures from a simple and more primitive condition.

Such a question may, at any rate, not unnaturally arise when we ask ourselves the question, What, on the whole, is the influence upon manhood—by which I mean, here and for my present purpose, the qualities that make courage, self-reliance, self-respect, industry, initiative—in fact, those independent and aggressive characteristics by which great races, like great men, have climbed up out of earlier obscurity and inferiority into power, leadership, and distinction; what is the influence upon these of conditions which tend, apparently by an inevitable law, to beget or to encourage indolence, inertia, parasitic dependence?

One can not but be moved to such a question by either of two papers which have recently appeared in these pages: I mean that entitled Abuse of Public Charity, by Comptroller Bird S. Coler; and that by Prof. Franklin H. Giddings, of Columbia University, on Public Charity and Private Vigilance. The community whose capable and efficient servant he is has reason to be thankful that, in the person of a public official intrusted with such large responsibilities, it has a thoughtful and far-seeing student of problems whose grave importance he has so opportunely pointed out. It needs the courage and the knowledge of such a one to affirm that "it is easier for an industrious and shrewd professional beggar to live in luxury in New York than to exist in any other city in the world," which, if any social reformer or minister of religion or mere critic of the social order had said it, would probably have been denounced as an atrabilious and unwarranted exaggeration.

Concerning the comptroller's indictments of certain charitable societies and organizations as expensive mechanisms for the consumption of appropriations or contributions largely spent upon their salaried officials, I am quite willing to recognize the force of Professor Giddings's demurrer to the effect that a so-called charitable society may now and then rightly exist, and expend its income largely, if not wholly, upon the persons whom it employs as its agents, since these agents are the vigilant committees whose office it is to detect, discourage, and expose unworthy objects, whether of public or private charity. But that, besides such agencies, there are constantly called into being wholly spurious organizations, which profess to exist for the relief of certain classes of sufferers or of needy people; that these succeed, sooner or later, in fastening themselves upon the treasury of the city and of the State; and that they are, in a great many cases, monuments of the most impudent and unscrupulous fraud, there can be no smallest doubt.

Well, it may be asked, What are you going to do about it? Will you accept the inevitable evils that march in the rear of all public or private charity, or will you sweep all the various agencies, which have relieved such manifold varieties of human want and alleviated to such an incalculable degree human misery, out of existence? Will you care to contemplate what a great city like New York or London would be if to-morrow you closed the doors of all the hospitals, *crèches*, homes of the aged, asylums for the crippled, the blind, the insane, and the like, and turned their inmates one and all into the street?

That is certainly a very dramatic alternative to present; but suppose that we look at it a little more closely. And, in order that we may, I shall ask my reader to go back with me, not to that primitive or barbaric era to which I began by referring, but only to a somewhat earlier stage in our own social history, with which many persons now living are abundantly familiar. One of the interesting and startling contrasts which might be presented to one anxious to impress a stranger with our American progress would be to take only our present century, and group together, out of its statistics, the growth and development, in its manifold varieties, during that period in any city, great or small, of institutional charity. But if such a one were just he would have, first of all, to put upon his canvas some delineation of that situation which, under so many varying conditions and amid such widely dissimilar degrees of privilege or of opportunity, preceded it. I listened the other day to the story of a charming woman, of marked culture and refinement, as she depicted, with unconscious grace and art, the life of a gentlewoman of her own age and class—she was young and fair and keenly sympathetic—on a Southern plantation before the civil war. One got such a new impression of those whom, under other skies and in large ignorance of their personal ministries or sacrifices, we had been wont to picture as indolent, exclusive, indifferent to the sorrow and disease and ignorance that, on a great rice or cotton or sugar plantation in the old days, were all about them; and one learned, with a new sense of reverence for all that is best in womanhood, how, in days that are now gone forever, there were under such conditions the most skillful beneficence and the most untiring sympathies.

But, in the times of which I speak, the service on the plantation for the sick slave (which, an ungracious criticism might have suggested, since a slave was ordinarily a valuable piece of property, had something of a sordid element in it) was matched in communities and under conditions where no such suspicion was possible. No one who knows anything of life in our smaller communities at the beginning of the century can be ignorant of what I mean. There was no village or smallest aggregation of families that had not its Abigail, its "Aunt Hannah," its "Uncle Ben," who, when there was sickness or want or sorrow in a neighbor's house, was always on hand to sympathize and to succor. I do not forget that it is said that, even under our greatly changed conditions, in modern cities this is still true of the very poor and of their kindness and mutual help to one another; and I thank God that I have abundant reason, from personal observation, to know that it is. But, happily, neither great cities nor small are largely made up of the very poor, and the considerations that I am aiming to present to those who will follow me through these pages are not concerned with these. What I am now aiming to get before my readers is that there was a time, and that it was not so very long ago, when that vast institutional charity which exists among us to-day, and which I believe to be in so many aspects of it so grave a menace to our highest welfare, did not exist, because it had no need to exist. The ordinary American community, East or West, had, as distinguishing it, however small its numbers and narrow its means, two characteristics which our modern systems of institutional charity are widely conspiring to extinguish and destroy. One of these was that resolute endurance of straitness and poverty of which there is so fine and true a portraiture in Miss Wilkins's remarkable story Jerome. I venture to say that the charm of that rare book, to a great many of the most intelligent and appreciative of its readers, lay in the fact that they could match it, or something like it, in their own experience; that they had known silent and proud women, and brave and proud boys, to whom, whatever the hard pinch of want that they knew, to accept a dole was like accepting a blow, and who covered their poverty alike from the eye of inquisitive stranger or kin with a robe of secrecy that was at once impenetrable and all-concealing. Life to them was a battle, and they could lose it, as heroes have lost it on the tented field, without a murmur; but to sue for bread to some other, even if that other were of the same blood, would have smitten them as with the stain of personal dishonor.

And over against such, in the days and among the communities of which I speak, were those whose gift and ministry it was—without an intrusive curiosity, without a vulgar ostentation, without a word or look that implied that they guessed the sore need to which they reached out—yet somehow to discover it, to succor it, and then to help, finest and rarest of all, to hide it.

Now, then, behind such a condition of things there was a sure and wise discernment, even if it was only instinctive, of a profound moral truth, which was this: that you can not help me, nor I you, without risk. For the most sacred thing in either of us is our manhood or womanhood—that thing which differentiates us from any mere mechanism, that thing in us which says, *I can, I ought, I will.* Take that out of human nature and what is left is not worth considering, save as one might consider any other clever mechanism. But the power to choose, the power to act, and the consciousness that choice and action are to be dominated by something that answers to the instinct of loyalty to God, to self-respect, to the ideals of honor and righteousness—that is what makes life worth living, and any conceivable thing worth seeking or doing. Now, the moment that the question of our mutual relations enters we have to be concerned with the way in which they will act on this power, quality, characteristic—call it what you will—that makes manhood. It is not enough, for example, that my impulse to give you a pint of gin is a benevolent impulse, if certain tendencies in you make it antecedently probable that a pint of gin will presently convert you from the condition of a rational being into that of a beast. And so of any impulse of mine in the direction of beneficence which, in its gratification, threatens manhood—that is, self-reliance, self-respect, independence, the right and faithful use of powers in me.

And here we come to the problem which lies at the basis of the whole question of charitable relief, for whatever class and in whatever form. The wholesome elements in that earlier situation, to which I have just referred, were threefold, and in our modern situation each one of them is sorely attenuated, if not wholly absent:

1. In the first place, there was a relative uniformity of condition. In other words, at the beginning of the present century in almost all communities, whether industrial or agricultural, the disparities of estate were inconsiderable. There was perhaps the rich man of the village or town, or two or three or half a dozen of them; but they were rich only relatively, and they were marked exceptions. The great majority of the people were of comparatively similar employments and circumstances. Among these there were indeed considerable varieties of task work, but work and wage were not far apart; and, what was of most consequence, a certain large identity of condition brought into it a certain breadth of sympathy and mutual help, out of which came the outstretched hand and the open door for the man who was out of work and was looking for it.

2. Yes, *who was looking for it.* For here again was a distinguishing note of those earlier days of which I am speaking. Idleness was a distinct discredit, if not dishonor. In communities where everybody had to work, an idler or a loafer was an intolerable impertinence, and was usually made to feel it.

3. And yet, again, there was the vast difference in those days from ours that the industries of the world had not taken on their immensely organized and *mechanized* characteristics. A mechanic —e. g., out of a job—then could turn his hand to anything that ordinary tools and muscle and intelligence could do. But an ordinary mechanic now must be a skilled mechanician in a highly specialized department, and when he is out of a job there, he is ordinarily out of it all along the line.

I might, as my reader will have anticipated me in recognizing, go on almost indefinitely in this direction; but I have said enough, I trust, to prepare him for the point which I want to make in connection with our modern charities and their mischief. Our modern social order, in a word, has become more complex, more segregated, more specialized. A whole class of people in cities—those, I mean, of considerable wealth—with a few noble exceptions (which, however, in our greater cities, thank God, are becoming daily less rare), live in profound ignorance of the condition of their fellow-citizens. Now and then, by some sharp reverse in the financial world or some national recurrence of "bad times," they are made aware that large numbers of their neighbors are out of work and starving. And, at all times, they are no less reminded that there is a considerable class—how appallingly large it is growing to be in New York Mr. Coler has told us—who need help, or think they do, and who, at any rate, more or less noisily demand it in the street, at the door, by begging letter, or in a dozen other ways that make the rich man understand why the prayer of Agur was, "Give me neither poverty nor riches." *

Well, something must be done, they agree. What shall it be? Shall the State do it, or the Church, or the individual? If only they could, as to that, agree! But it has been one of the most pathetic notes of our heedless and superficial treatment of a great problem that, here, there has not been from the beginning even the smallest pretense of a common purpose or any moderately rational course of action. Undoubtedly it is true that there is no imaginable mechanism that could relieve any one of these agencies from responsibility in the matter of relief to the unfortunate, nor is it desirable that there should be. Sometimes it has been the Church that has undertaken the relief of the poor and sick, sometimes it has been largely left to the individual, and sometimes it has been as largely left to the State. But, in any case, the result has been almost as often as otherwise mischievous, or corrupt and corrupting. For, in fact, the ideal mode of dealing with the problems of sickness, destitution, and disablement should be one in which the common endeavor of the State, the Church, and the individual should be somehow unified and co-ordinated. But, incredible as it ought to be, the history of the best endeavors toward such co-ordination has been a history of large inadequacy and of meager results. As an illustration of this it is enough to point to the history of the Charity Organization Society in New York, which, I presume, is not greatly different from that of similar societies elsewhere. Antecedently it would have seemed probable that such a society, which aims simply to discourage fraud, to relieve genuine want, and to protect the community from being preyed upon by the idle and the vicious, would have the sympathy of that great institution, some of whose teachings are, "If any man will not work, neither shall he eat"; "Stand upright on thy feet";

* Proverbs xxx, 8.

"Provide things honest in the sight of all men"; "Not slothful in business"; and the like. But, as a matter of fact, such societies have had no more bitter antagonists than the churches, and no more vehement opponents than ministers of religion. In a meeting composed of such persons I have heard one of their number denounce with the most impassioned oratory any agency which undertook, by any mechanism, to intrude into the question of the circumstances, resources, or worthiness of those who were the objects of ecclesiastical almsgiving. Who, he demanded, could know so well as the clergy all the facts needed to enable them wisely and judiciously to assist those worthy and needy brethren who were of their own household of faith? Nothing could sound more plausible or probable; but in a little while it happened that a woman who had for years been a beneficiary of this very pastor died, leaving behind her, among her effects, sundry savings-bank books which showed her to be possessed of some thousands of dollars, which she bequeathed to relatives in a distant land. Still more recently a case of a similar character has occurred in which a still larger amount having been paid over in small sums through a long series of years by a church, the whole, with interest, has been found to have been hoarded, the recipient having been a person entirely capable of self-support, and, as a matter of fact, during the whole period self-supporting, and the large accumulations are at present the subject of a suit in which the church is endeavoring to recover what it not unnaturally regards as its own misappropriated money.

And yet, as any one knows who knows anything of the delicacy, vigilancy, and thoroughness with which a well-organized society conducts its work, any such grotesque and deplorable result would, with a little wise co-operation between the Church and such a society, have been rendered impossible. I know how impatient many good people are of the services of any such association, and we have all heard *ad nauseam* of their protests against a "spy system which invades the sacred privacy of decent poverty," and the rest; but, in fact, such persons never seem to realize that, in one aspect of it, the Church stands, or, as a matter of common honesty, as the administrator of trust funds, ought to stand, on the same equitable basis, at least, as a life-insurance company. Now, when I seek the benefits of a life-insurance company I am asked certain questions which affect not only my physical resources but my diseases, my ancestry and their diseases, my personal habits, infirmities, and the like. If the company has the right, in the just interests of its other clients, to ask these questions, as administering a large trust, has not the Church, which is also the administrator of a trust no less in the interest of other clients?

But, indeed, this is the lowest aspect of such a question, and I freely admit it. The title of this paper points to that gravest aspect of it, with which I am now concerned. The largest mischief of indiscriminate almsgiving is not its wanton waste—it is its inevitable and invariable degradation of its objects. I have spoken of the grave antagonism of the Church to wisely organized charity, but it is but the echo of the hostility of the individual, and often of the best and wisest men and women. Elsewhere (but not, I think, in print) I have related an incident in this connection of which one is almost tempted to say *ex uno disce omnes.* Approaching one day, when I was a pastor in a great city, the door of one of my clerical brethren, I observed a woman leaving it who, though she hastily turned her back upon me, I recognized as a member of my own congregation. On entering my friend's study I said to him:

"I beg your pardon, but was not that Mrs. —— whom I saw leaving your door a moment ago?"

"Yes."

"What was she after, may I ask?"

My friend—now, alas! no longer living—was a man distinguished by singular delicacy and chivalry of character and bearing, and he turned upon me with some surprise and *hauteur* and said:

"Well, yes, you may ask; but I do not know that, in the matter of the sad and painful circumstances of one of my own parishioners, I am called upon to answer."

"Precisely," I replied; "but, as it happens, she isn't your parishioner."

"What do you mean, sir?" he exclaimed, with some heat. "Do you suppose that I don't know the members of my own flock?"

"On the contrary," I said, "I have no doubt that you know not only them but the members of a great many other flocks, as in the instance of the person who has just left your door, who, as it happens, has been a member of the church of which I am rector for some fifteen years."

The remark and the abundant evidence with which I was able to re-enforce it at last persuaded my friend to institute further inquiries, which resulted in the discovery that the subject of those inquiries maintained similar relations with some seven parishes, from every one of which she was receiving, as a poor widow, a monthly allowance! And yet my reverend brother was one of the most strenuous opponents of any system or society, any challenge or interrogation which, as he said, came between him and *his* poor. Alas! though in one sense they were his poor, in another they were as remote from him as if they and he had been living in different hemispheres. With every sympathy for their distresses, he had not come to recognize that, under those complex conditions of our modern life, to which I have already referred, a real knowledge of the classes upon whom need and misfortune and the temptations to vice and idleness press most heavily has become almost a science, in which training, experience, most surely a large faith, but no less surely a large wisdom, are indispensable.

In this work there is undoubtedly a place for institutional charity, and also for that other which is individual. The former affords a sphere for a wise economy, for prompt and immediate treatment or relief, and for the utilization of that higher scientific knowledge and those better scientific methods which the home, and especially the tenement house, can not command. But over against these advantages we are bound always to recognize those inevitable dangers which they bring with them. The existence of an institution, whether hospital, almshouse, or orphanage, to the care of which one may easily dismiss a sick member of the household, or to which one may turn for gratuitous care and treatment, must inevitably act as strong temptations to those who are willing to evade personal obligations that honestly belong to them. In connection with an institution for the treatment of the eye and ear, with which I happen to be officially connected, it was found, not long ago, that the number of patients who sought it for gratuitous treatment was considerably increased by persons who came to the hospital in their own carriages, which they prudently left around the corner, and whose circumstances abundantly justified the belief that they were quite able to pay for the treatment, which, nevertheless, their self-respect did not prevent them from accepting as a dole. Such incidents are symptomatic of a tendency which must inevitably degrade those who yield to it, and which is at once vicious and deteriorating. How widespread it is must be evident to any one who has had the smallest knowledge of the unblushing readiness with which institutional beneficence is utilized in every direction. A young married man in the West, I have been told, wrote to his kindred in the East: "We have had here a glorious revival of religion. Mary and I have been hopefully converted. Father has got very old and helpless, and so we have sent him to the county house." One finds himself speculating with some curiosity *what* religion it was to which this filial scion was converted. Certainly it could not have been that which is commonly called Christian!

And at the other end of the social scale the situation is often little better. In our greater cities homes have been provided for the aged, and especially for that most deserving class of gentlewomen who, having been reared in affluence, come to old age, after having struggled to maintain themselves by teaching, needlework, and the like, with broken powers and empty purses. But it has, I am informed, been often impossible to find places for them in institutions especially created for their care, because its lady managers have filled their places with their own worn-out servants, who, having spent their years and strength in their employer's service, are turned over in their old age, with a shrewd frugality which one can not but admire, to be maintained at the cost of other people. It is impossible to confront such instances, and they might be multiplied indefinitely, without recognizing how enormous are the possibilities of mischief even in connection with the most useful institutional charity.

And yet these are not so great as those which no less surely follow, as it is oftenest administered, in the train of individual beneficence. In an unwritten address, not long ago, I mentioned an illustration of this which I have been asked to repeat here. While a rector in a large city parish, I was called upon by a stranger who asked for money, and who, as evidence of his claims upon my consideration, produced a letter from my father, written some twenty-five years before, when he was Bishop of Pennsylvania. The writer had, when this letter was placed in my hands, been dead for some twenty years, but, in a community in which he had been greatly loved and respected, his words had not, even in that lapse of time, lost their power. The letter was a general letter, addressed to no one, and therein lay its mischief. When read, it had in each instance been returned to its bearer, and he soon discovered that he had in it a talisman that would open almost any pocket. He was originally a mechanic who had been temporarily disabled by a fit of sickness; when I saw him, however, he was obviously, and doubtless for years had been, in robust health. But he had discovered that if he were willing to beg he need not work, and he had long before made his choice on the side of ease and indolence. After reading the letter which he produced, and looking at its date and soiled condition, both revealing the long service that it had performed, I said to him, "No, I will not give you anything, but I will pay you ten dollars if you will let me have that letter." It would not be easy to describe the leer of cunning and contempt with which he promptly took it out of my hand, folded it, placed it in his pocketbook, and left the room. He was not so innocent as to surrender his whole capital in trade!

Now, here was a man to whom a well-meaning but inconsiderate act of kindness had been the cause of permanent degradation.

The highest qualities in such a one—manhood, self-respect, frugal and industrious independence—had been practically destroyed, and an act of charity had made of one who was doubtless originally an honest and hard-working young man, a mendicant, a loafer, and a fraud.

And yet for a sincere and self-sacrificing purpose to help our less fortunate fellow-men there were never so many inspiring and encouraging opportunities. Along with the undeniably increasing complexity of our modern life there have arisen those attractive instrumentalities for a genuine beneficence which find their most impressive illustrations in the improvements of the homes of the poor in college settlements, in young men's and young girls' clubs in connection with our mission churches, in the kindergartens and in the cooking schools founded by these and other beneficent agencies, in juvenile societies for teaching handicrafts and encouraging savings, and, best of all, in that resolute purpose to know how the other half live, of which the noble service of Edward Denison in England; of college graduates in England and in America, who have made the college and university settlements their post-graduate courses; of such women here and in Chicago as Miss Jane Addams, and the charming group of gentlewomen living in the House in Henry Street, New York, maintained with such modest munificence by Mr. Jacob Schiff; of such laborious and discerning scrutiny and sympathy as have been shown in the studies and writings of my friend Mr. Jacob Riis—are such noble and enkindling examples.

These and such as these are indicating to us the lines along which our best work for the relief of ignorance and suffering and want may to-day be done, and the more closely they are studied, and the more intimately the classes with which they are concerned are known, the more abundantly they will vindicate themselves. For these latter have in them, far more commonly than we are wont to recognize, those higher instincts of self-respect and of manly and womanly independence that, in serving our fellow-men, we must mainly count upon. There are doubtless instinctive idlers and mendicants among the poor, as, let us not forget, there are chronic idlers, borrowers, "sponges," among the classes at the other end of the social scale. But the same divine image is in our brother man everywhere, and the better, more truly, more closely we know him, the more profoundly we shall realize it. During some six weeks spent, a few years ago, in the most crowded ward in the world, among thousands of people who lived in the narrowest quarter and upon the most scanty wage, I gave six hours every day to receiving anybody and everybody who came to me. During that time I had visits from dilapidated gentlemen from Albany and Jersey City and Philadelphia and the like, who supposed that I was a credulous fool whose money and himself would be soon parted, and who gave me what they considered many excellent reasons for presenting them with five dollars apiece. But, during that whole period, not one of the many thousands who lived in the crowded tenements all around me, and to hundreds of whom I preached three times a week, asked me for a penny. Not one! They came to me by day and by night, men and women, boys and girls, for counsel, courage, sympathy, admonition, reproof, guidance, and such light as I could give them—but never, one of them, for money. They are my friends to-day, and they know that I am theirs; and, little as that last may mean to the weakest and the worst of them, I believe that, in the case of any man or woman who tries to understand and hearten his fellow, it counts for a thousandfold more than doles, or bread, or institutional relief.

THE HOPI INDIANS OF ARIZONA.

By GEORGE A. DORSEY.

As one approaches the center of Arizona, along the line of the Santa Fé Railroad, whether he come from the east or from the west, his attention is sure to be arrested by several tall, spire-like hills which are silhouetted against the sky to the far north. These peaks are the Moki Buttes, and to the north of them lies the province of Tuscayan, the land of the Mokis, or the Hopis, as they prefer to be called. That country to-day contains more of interest to the student of the history of mankind than any other similar-sized area on the American continent. But very few of the great throng that roll by on the Santa Fé trains every year in quest of pleasure, of recreation, of new scenes and strange, stop off at Holbrook or Winslow to take the journey to the Hopis, and very few even know of the existence of these curiously quaint pueblos of this community, which to-day lives pretty much as it did before Columbus set out on his long voyage to the unknown West.

The term *pueblo*, a Spanish word meaning town, is by long and continued use now almost confined to the clusters of stone and adobe houses which to-day shelter the sedentary Indians of New Mexico and Arizona. Not only are these Indian towns called "pueblos," but we speak of the Indians themselves as the Pueblo Indians, and of the culture of the people—for they all have much in common—as the pueblo culture. This similarity of culture is not due to

Terrace Scene, Streets of Oraibi.

unity of race or of language, but is the resultant of a peculiar environment. In recent times, the limits of the pueblo-culture area have contracted to meet the demands of the white man; we know also that before the advent of the Spaniard many once populous districts had been abandoned, and as a result there came to be fewer but larger villages. We know also, both from tradition and from archæological evidence, that in former days the pueblo people inhabited many of the villages of southern Colorado and Utah, and that the Hopis and their kin were numerous in many parts of Arizona. The silent houses of the cliffs, the ruins of central Arizona, and the great crumbling masses of adobe of the Salt and Gila River valleys and in northern Chihuahua are all former habitations of the Pueblo Indian. To-day there are no representatives of these people in Utah or Colorado, while the seven Hopi towns of Tusayan alone remain in Arizona. But there are still many pueblos scattered along the Rio Grande, Jemez, and San Juan Rivers in New Mexico. Alike in culture, we may divide the existing pueblos into four linguistic groups—namely, the Hopis of Arizona, the Zuñis of New Mexico, the Tehuas east of the Rio Grande, and the Queres to the west of the Rio Grande. Of the earlier home of the last three stocks we know but little. The ancestors of the Hopis we know came from different directions—some from the cliff dwellings of the north, others from central Arizona. To-day, however, they form a congeries of clans united and welded into a unit by similarity of purpose and by the more powerful influence of a peculiar environment.

The opinion was held until within a very few years that the Hopis represented a small branch of the Shoshonean division of the Uto-Aztecan stock, but Dr. Fewkes, our greatest authority on the Hopi, has questioned the accuracy of this classification, and it can be stated that the true affinities of the Hopi have not yet been discovered.

The province of Tusayan, or the Moqui Reservation, as it is officially known to-day, contains about four thousand square miles and about two thousand Indians. It is in the northeastern part of Arizona, and its towns are about eighty miles by trail from the railroad. The present inhabitants are grouped in seven pueblos, located on three parallel *mesas*, or table-lands, which extend southward like stony fingers toward the valley of the Little Colorado River. The first or east mesa contains the pueblos of Walpi, Sitcomovi, and Hano; on the second or middle mesa are Miconinovi, Cipaulovi, and Cuñopavi; and on the third or west mesa stands Oraibi, largest and most ancient of all Hopi pueblos, and in many respects the best preserved and most interesting community in the world. A community without a church, separated by a broad, deep valley from its nearest neighbor, with but a single white man within twenty miles, removed nearly thirty-five miles from a trading post, isolated, proud, spurning the advances of the Government, Oraibi could maintain its independence if every other community on the earth were blotted out of existence.

The journey from Winslow to Oraibi is not without great interest. The beautiful snow-capped peaks of the San Francisco Mountain are always in sight far away to the west, and when the eye tires of the rigid and immovable desert their graceful outlines

Street Scene, Oraibi.

check the often rising feeling of utter helplessness. Then there is a sweep and barrenness of the plain which is impressive and often awe-inspiring, and which at times produces a feeling similar to that created by the sea. Save for the stunted cottonwoods along the Little Colorado River, there is scant vegetation to relieve the bright reds, yellows, and blues of the painted desert over which the sun's heat quivers and dances, revealing here and there mirages of lakes and forests of wonderfully deceptive vividness. Arising out of the plain here and there are brief expanses of table-lands, with the soft under strata crumbled away and the higher strata having fallen down the sides, producing often the appearance of a ruined castle. At the foot of the mesas are clumps of sagebrush and grease wood, while the plain is dotted here and there with patches of cactus and bright-colored flowers. Foxes and wolves are common enough, and we are rarely out of sight or sound of the coyote, bands of which make night hideous with their shrill, weird cry.

Although the Navajo country proper is to the north and east of Tusayan, their *hogans*, or thatched-roofed dugouts, are met with here and there along the valley of the river. The Navajos are the Bedouins of America. We often see the women in front of the hogans weaving, or the men along the trail tending their flocks of sheep and goats, for they are great herders and produce large quantities of wool, part of which they exchange to the traders; the remainder the women weave into blankets, which are in general use throughout the Southwest and which find their way through the trade to all parts of the relic-loving world. They raise, in addition, great quantities of beans, which they also send out to the railroad. They are better supplied with ponies than the Hopi, and with them make long journeys, for the Navajos do not live a communal life as do the pueblo people, but are scattered over an extensive territory, each family living alone and being independent of its neighbors.

Street Scene, Oraibi.

After a long and tiresome journey of four days we arrive at the foot of the mesa and begin the long, upward climb, for Oraibi is eight hundred feet above the surrounding plain and seven thousand feet above the level of the sea. Just before the crest is reached the trail for fifty or more feet is simply a path along and up the base of a rocky precipice, its steps worn deep by the never-ending line of Indians passing to and fro. Once upon the summit we have an unobstructed view over the dry, arid, sun-parched valleys for many miles—a view which, in spite of its desolation, is extremely fascinating.

We often speak of this or of that town as the oldest on the continent. But here we are in the streets of a town which antedates all other cities of the United States—a pueblo which occupied this very spot when, in 1540, Coronado halted in Cibola and sent Don Pedro de Tobar on to the west to explore the then unknown desert. Imagine seven rather irregularly parallel streets about two hundred yards long, with here and there a more open spot or plaza, lined on each side with mud-plastered, rough-laid stone houses, and you have Oraibi. The houses rise in the form of terraces to a height of two or three stories. As a rule there is no opening to the ground-floor dwellings save through a small, square hatch in the roof. Leading up to this roof are rude ladders, which in a few rare instances are simply steps cut in a solid log, differing in nowise from those found leading into the chambers of the old cliff ruins of southern Colorado. The roof of the first row or terrace of houses forms a kind of balcony or porch for the second terrace, and so the roof of the second-story houses serves a similar useful purpose for the third-story houses.

Two things impress one on entering a Hopi home for the first time—the small size of the rooms, with their low ceilings, and the cleanness of the floors. Both floors and walls are kept fresh and bright by oft-renewed coats of thin plaster, which is always done by the woman, for she owns the house and all within it; she builds it and keeps it in repair. The ceiling is of thatch held up by poles, which in turn rest on larger rafters. Apart from the mealing bins and the *piki* stones, to be described later, there is no furniture—no table, no chairs, no stools, simply a shelf or two with trays of meal or bread, and near the wall a long pole for clothing, suspended by buckskin thongs from the rafters. Their bed is a sheepskin rug and one or two Navajo blankets spread on the floor wherever there may be a vacant space. In one corner may be a pile of corn stacked up like cordwood, and in another corner melons or squashes and a few sacks of dried peaches or beans. Between the thatch and rafters you will find bows and arrows, spindles, hairpins, digging-sticks, and boomerangs, and from the wall may hang a doll or two, children's playthings. Such is an Oraibi home; but it always seems a happy home, and the traveler is always welcome.

A prominent feature of almost every pueblo plaza is a squarish, boxlike elevation which extends about two feet above the level of the earth and measures about six feet in length, with a two-foot hole in the center, from which projects to a considerable height the posts of a ladder. If you descend this ladder you will find yourself in a subterranean chamber, rectangular in shape, and measuring about twenty-five feet in length by about fifteen feet in breadth, with a height from the floor to the ceiling of about ten feet. This underground room is the *kiva*, or the *estufa* of the Spaniards. Here are held all the secret rites of religious ceremonies, and here the men resort to smoke, to gossip, to spin, and weave. The floor, to an extent of two thirds of the entire length, except for a foot-wide space extending around this portion, is excavated still farther to a depth of a foot and a half. The remaining elevated portion is for the spectators, while the banquette around the excavation is used by the less active participants in the ceremonies. Just under the hatchway and in front of the spectators' floor is a depression which is used as a fire hearth. The walls are neatly coated with plaster, and the entire floor is paved with irregularly shaped flat stones fitted together in a rough manner. There is sometimes inserted in the floor, at the end removed from the spectators, a plank with a circular hole about an inch and a half in diameter; this hole is called the *sipapu*, and symbolizes the opening in the earth through which the ancestors of the Hopi made their entrance into this world. The roof of the kiva is supported by great, heavy beams, which are brought from the San Francisco Mountain with infinite trouble and labor. In Oraibi there are thirteen kivas, each probably in the possession of some society, one of which belongs to women, who there erect their altar in the *mamzrouti* ceremony. Oraibi has the largest number of kivas of any of the Hopi pueblos; in a single plaza there are no less than four kivas. This plaza is on the west side of the village, and one of the kivas is of special interest, for in it are held the secret rites of the weird snake ceremony. A little to the west of this plaza is a small bit of the mesa, standing apart and separated from the main mesa by a depression. This is known as "Oraibi rock," whence the pueblo takes its name. The etymology of this name "Oraibi" is lost in a misty past, but the rock is still held in great veneration. On it stands a rude shrine, where one may always find sacrificial offerings of prayer-sticks, pipes, sacred meal, cakes, etc.

The roof of a Hopi house is always of interest. Here we may see corn drying in the sun or loads of fagots ready for use, women dressing their hair or fondling their babies, or groups of children playing or roasting melon seeds in an old broken earthenware vessel which rests on stones over a fire. From the projecting rafters are ears of corn hung up to dry, or pieces of meat placed there to be out of reach of the dogs, or bunches of yarn just out of the dye pot. When a ceremony is being performed in some one of the plazas the roofs near by present a scene which is animated in the extreme, every square foot of space being occupied by a merry, good-natured throng of young and old. As one looks from one group to another it is impossible not to notice the stunted and dwarfed appearance of the women, which is in marked contrast to that of the men, who are beautifully formed, of medium height, and of well-knit frames.

AN ORAIBI MOTHER AND CHILDREN.

There is not, however, the same powerful ruggedness or splendid development among these pueblo dwellers which we find among the plains Indians, for the days of the Hopi women are spent in carrying water and grinding corn, while the men in summer till their fields and in winter spin and weave.

In considering the routine life of the Hopi it is hard to draw a sharp line between what we may call his regular daily occupations and his religious life, for they are closely interwoven. He is by nature a religionist, and he never forgets his allegiance and obligations to the unseen forces which control and command him.

In nothing is the primitiveness or the absence from contamination of the Hopi better revealed than in the children, for here, as elsewhere, is it shown that they are the best conservators of the habits and customs of ancestral life. What utter savages the little fellows are! Stark naked generally, whether it be summer or winter, dirty from head to foot, their long black hair disheveled and tangled and standing out in every direction, their head often resembling a thick matted bunch of sagebrush. They are never idle; now back of the village behind tiny stone ramparts eagerly watching their horsehair bird snares, or engaged in a sham battle with slings and corncobs, or grouped in threes or fours about a watermelon, eagerly and with much noise gorging themselves to absolute fullness, or down on the side of the mesa playing in the clay pits. A not uncommon sight is that of two or three little fellows trudging off in pursuit of imaginary game, armed with miniature bows and arrows or with boomerangs and digging-sticks. In their disposition toward white visitors they are extremely shy and reticent, but they are also very inquisitive and curious, and, furthermore, they have a sweet tooth, and one only need display a stick of candy to have half the infantile population of the pueblo at his heels for an hour at a time. If perchance one of the little fellows should die, he is not buried in the common cemetery at the foot of the mesa, but he is laid away among the rocks in some one of the innumerable crevices which are to be found on all sides near the top of the mesa, for the Hopis, in common with many other native tribes of America, believe that the souls of departed children do not journey to the spirit land, but are born again.

As the girls reach the age of ten or twelve they distinguish themselves by dressing their hair in a manner which is both striking and absolutely unique on the face of the earth. The hair is gathered into two rolls on each side of the head, and then, at a distance of from one to two inches, is wound over a large U-shaped piece of wood into two semicircles, both uniting in appearance to form a single large disk, the diameter of which is sometimes as much as eight inches. After marriage the hair is parted in the middle over the entire head, and is gathered into two queues, one on each side, which are then wound innumerable times by a long hair string beginning a few inches from the head and extending about four inches. The ends of the queues are loose. Hopi maidens are, as a rule, possessed of fine, regular features, slender, lithe, and graceful bodies, and are often beautiful. But with the early marriage comes a daily round of drudgery, which prevents full development and stunts and dwarfs the body. But to old age she is generally patient, cheerful, nor does she often complain. Lines produced by toil and labor may show in her face, but rarely those of worry or discontent. Even long before marriage she has not only learned to help her mother in the care of her younger brothers and sisters, but she has already trained her back to meet the requirements of the low-placed corn mills. From her tenth year to her last it has been estimated that every Hopi woman spends on an average three hours out of every twenty-four on her knees stooping over a *metate*, or corn-grinder, for corn forms about ninety per cent of the vegetable food of the Hopis.

In every house you will find, in a corner, a row of two, three, or four square boxlike compartments or bins of thin slabs of sandstone set on edge. Each bin contains a metate set at an angle with its lower edge slightly below the level of the floor. There is a clear space around each stone to permit of a better disposition of the corn and meal. The texture of the metates is graduated from the first to the last, the final one being capable of grinding the finest meal. Accompanying the metate is a crushing or grinding stone about a foot in length and from three to four inches wide. Its under surface is flat, while its upper surface is convex to a slight extent, so as to permit of its being grasped firmly by the thumb and fingers of both hands. The corn is ground between these two stones, the upper one being worked up and down the metate by a motion of the operator not unlike that of a woman washing clothes on a washboard. The favorite position assumed by the woman while working is to sit on her knees, her toes resting against the wall of the house behind her. Of the many colors of corn used by the Hopis, blue is the most common, and corn of this color is ordinarily employed in the making of bread; other colors, however, are used for the piki consumed in ceremonial feasts.

Woman of Oraibi making Coiled Pottery.

The stone used by the Oraibians for making piki is from a sandstone quarry near Burro Springs. It is about twenty inches long by fourteen broad, and is three inches thick. The upper surface is first dressed by means of stone picks, and is polished by a hard rubbing-stone, and then finally treated with pitch and other ingredients until its surface is as smooth as glass. It is mounted on its two long edges by upright slabs, so that it stands about ten inches from the level of the floor, the floor itself being usually excavated to a depth of two or three inches beneath the stone. At a height of about four feet above this primitive griddle is a large rectangular hood which is extended above the roof in the form of a chimney made of bottomless pots, one resting on the other. Kneeling in front of the stone and supporting her body with her left arm, the woman coats the stone with the thin batter of corn and water with the fingers of her right hand. After a few seconds' time she lifts the waferlike sheet from the stone and transfers it to a mat which is made for this special purpose. For some time the piki remains soft and pliable, and while in this condition she rolls or folds the sheets according to her custom—some folding, others rolling it. It is a curious sight on the feast days of certain ceremonies to see women gathering from all quarters of the village at an appointed house, each carrying a tray heaped high with rolls of this paper bread.

The Hopis are among the foremost potters in North America, when we take into consideration the fineness of the clays used and the character of the decoration. But in many respects, especially in form, their ware is much inferior to that of the ancient Mexicans and Peruvians. They make pottery to-day as they did hundreds of years ago, but the quality of the work has greatly deteriorated and the earthenware now produced is not to be compared with that found in near-by Hopi ruins. It should be kept in mind, however, that the specimens found in the ancient graves are to a certain extent ceremonial, and consequently better made and more ornate in their decoration than those which were made simply for household purposes. Still, there are a fineness of texture and a delicacy of coloring in the ancient ware which can not now be produced. It is to be noted, also, that the Hopi woman of to-day can not decipher the designs on the earlier pottery, although she often copies them. The demand for earthenware vessels, however, is nearly as great at present as it was in prehistoric days, for you may search the homes of Oraibi for a long time without finding a tin pan or an iron pot. Thus it is that every Hopi woman must be a worker in clay, and one of the occasional sights is that of a woman on her "front porch" surrounded by vessels of all sizes and in varying degrees of completeness. The process of pottery-making is somewhat as follows: "After the clay has been worked into a plastic mass she draws out from it a round strip the size of one's finger and about five inches in length. This is coiled flat in the bottom of the tray, and forms the base of the vessel. Other clay strips are kneaded out of the mass, and these are coiled in a gradually increasing spiral, the desired shape and proportion being acquired at the same time, until the vessel has reached its proper height. The sides of the vessel are then thinned down, and both inside and outside are made smooth by means of small bits of gourds and polishing-stones. The vessel is then ready for a coat of wash, after which it is painted and fired. This method of making pottery is not peculiar to the pueblos, but is found among some of the tribes of South America.

The art of basketry was never brought to a high state among the Hopis, for they confine themselves chiefly to the manufacture of large shallow trays and rough baskets made of the long, pliable

Oraibi Rock, upon which stands Katcin Kiku, the Principal Oraibi Shrine.

leaves of the yucca or of some other fiber. These answer all ordinary domestic requirements. From the reddish-brown branches of a willowlike bush which grows near, the Hopi mother interweaves a cradle board for her children. This cradle is peculiar in its shape, and especially so in its construction, and differs greatly from that in use among the plains Indians. Another singular point to be noted is the fact that this cradle board is not often strapped to the back, but is usually in the arms, or, more often still, is placed on the floor by the side of the mother as she works. The Oraibi mesa, like other table-lands of Tusayan, is destitute of water. The nearest spring is in the valley at the foot of the mesa nearly a mile away. From before sunrise to ten o'clock of every day there is an almost unbroken line of water carriers going and coming from the spring, bending under the weight of a large jar which they carry on their back by means of a blanket, the ends of which are tied in a knot on their forehead. No wonder these women grow prematurely old. Winter for them, however, has its advantages, for they have an ingenious way of utilizing the snow to save them from the necessity of going down the mesa for water. One of the most extraordinary sights I saw was that of a Hopi woman and her little girl trudging along, each bent almost to the ground under the weight of an immense snowball. These they were carrying home on their backs, enveloped in a blanket. About half a mile from the pueblo, back on the mesa, reservoirs have been scooped out in the soft sandstone, which are often partially filled by the spring rains, but the water soon becomes brackish and is not potable, but is used for washing clothes.

The costume of the woman consists ordinarily of four pieces—a blanket, dress, belt, and moccasins. The blanket is of wool, and is about four feet square. It is blue in color, with a black border on two sides. These two edges are usually bound with a heavy green or yellow woolen thread. To make the dress, this blanket is once folded and is sewn together with red yarn at the long side, except for a space sufficiently large to accommodate one arm. The folded upper border is also sewn for a short space, which rests on one of the shoulders. The other shoulder and both arms are bare, except as they may be partially covered by the blanket. The belt or sash is of black and green stripes, with a red center, ornamented with geometric designs in black; it is about four inches wide, and is long enough to permit of being wound around the waist two or three times. The moccasins are of unpainted buckskin, one side of the top of which terminates in a long, broad strip, which is wound round the leg several times and extends up to the knee, thus forming a thick legging. More than half the time the Hopi woman is barefooted. The girls wear silver earrings, or suspend from the lobe of the ear small rectangular bits of wood, one side of which is covered with a mosaic of turquoise. This custom is of some antiquity, as ear pendants exactly similar to these have been found in the Hopi ruins of Homolobi, on the Little Colorado River.

In addition to this regulation costume, worn on all ordinary occasions, each Hopi woman is supposed to own a bridal costume and two special blankets, which are worn only in ceremonies, and hence need not here be described. The bridal costume consists of a pair of moccasins, two pure white cotton blankets, one large and the other small, both having large tassels of yellow and the black yarn at each corner, and a long, broad, white sash, each end of which terminates in a fringe of balls and long thread. All three garments, provision is made for its erection. From the wall near the ceiling project two wooden beams, on which, parallel to the floor, is a long wooden pole, and to this is fastened, by buckskin thongs, the upper part of the loom. Immediately under this pole is a plank, flush with the floor, in which at short intervals are partially covered U-shaped cavities in the wood, through which are passed buckskin thongs which are fastened to the lower pole of the loom. The sets of thongs are long enough to permit of the loom being lowered or raised to a convenient height. While at work the weaver generally squats on the floor in front of his loom, or he occasionally sits on a low, boxlike stool. It is no uncommon sight to see, at certain times of the year, as many as six or eight looms in operation at one time in a single kiva. The men also do all the sewing and embroidering. Practically all the yarn consumed by the Hopis is home-dyed, but the colors now used are almost entirely from aniline dyes and indigo. Cotton is no longer used except in the manufacture of certain ceremonial garments, all others being made of wool. They own their own sheep, which find a scant living in the valleys; for the better protection of the sheep from wolves they also keep large numbers of goats.

Although the men do all the weaving, they do but little of it for themselves. For the greater part of the year their only garment is the loin cloth—a bit of store calico. In addition, they all own a shirt of cheap black or colored calico, which is generally more or less in rags, and a pair of loose, shapeless pantaloons, made often from some old flour sack or bit of white cotton sheeting. It is a rather incongruous sight to see some old Hopi, his thin legs incased in a dirty, ragged pair of flour-sack trousers, on which can still be traced "XXX Flour, Purest and Best."

Neither sex scarifies, tattoos, or paints any part of the body except in ceremonies, when colored paints are used as each ceremony requires. The men often wear large silver earrings, and suspend from their neck as many strands of shell and turquoise beads as their wealth will allow. Some of the younger men wear, in addition, a belt of large silver disks and a shirt and pantaloons of velvet. Most of their silver ornaments, it should be noted, however, have been secured in trade from the Navajos, who are the most expert silversmiths of the Southwest.

When the Hopi isn't spinning or weaving, he is in his kiva praying for rain, or he is in the field keeping the crows from his corn. I was once asked if the Hopis plow with oxen or horses. They use neither; they do not plow. When they plant corn they dig a deep hole in the earth with a long, sharp stick until they reach the moist soil. When the corn is sprouted and has reached

Valley Scene; Fields and Peach Trees. Oraibi on Mesa to the Right.

a height of a few inches there is always the possibility of its being blown flat by the wind or overwhelmed in a sand storm. To provide against this the Hopi incloses the exposed parts of his little field with wind-breakers, made by planting in the earth thick rows of stout branches of brush. These hedges even are often overwhelmed by the sand and completely covered up.

And the crows, and the stray horses, and the cattle! Surely the poor Indian must fight very hard for his corn. For nearly two months he never leaves it unguarded, and that he may be comfortable he makes a shelter behind which he can escape the burning rays of the July and August sun. The shelters are occasionally rather pretentious affairs, at times consisting of a thick brush roof, supported by stout rafters which rest on upright posts. More often, however, they simply consist of a row of cottonwood poles, five or six feet high, set upright at a slight angle in the earth.

Although corn is by far the most important vegetable food, the rich though sun-parched soil yields large crops of beans and melons of all kinds.

Peach orchards also thrive in the sheltered valleys near the mesa, and in the fall great patches of peaches may be seen spread out to dry on the rocks of the mesa to the north of the village. Of both beans and peaches the Hopis generally have large quantities for the outside market, which they take over to the railroad on the backs of burros or ponies.

Before leaving the subject of the daily life of the male portion of Oraibi I have still to mention a curious weapon of which they make occasional use. This is the throwing-stick, or so-called boomerang, which differs only slightly from that used by the aborigines of Australia; the Hopi stick, however is better made, and is ornamented by short red and black lines. This is the weapon of the young men, and with it they work havoc with the rabbits which infest the valleys. But although they have good control over it, as can often be seen on their return from a hunt, they are not able to cause its return as can the Australians. At first thought it seems rather strange that the boomerang should have been evolved by two groups of mankind dwelling in parts of the world so remote, but we must look for the explanation of this phenomenon in the fact that the natural conditions of the two countries have much in common—a generally level, sandy country, with here and there patches of brush, a peculiar condition which would readily yield itself to the development of an equally peculiar and specialized weapon.

For fire the Hopi depends almost entirely on the rank growth of brush which is found along the ravines. This suffices to supply heat to the piki stone and the boiling pot, and enough to keep a fire on the hearth in the kiva. But now and then he must make a distant journey to that part of the mesa where the supply of stunted and scrubby pines and piñons has not already been exhausted; for by custom four kinds of fuel are prescribed for the kivas, and to keep the hearth replenished with these often necessitates long journeys. As the woman bends under her water jar, so the man staggers along under his load of fagots, often carried from a distance of several miles.

REFORM OF PUBLIC CHARITY.

By BIRD S. COLER,
COMPTROLLER OF THE CITY OF NEW YORK.

ABUSE of municipal charity in New York city has reached a stage where immediate and radical reform is necessary in order to prevent the application of public funds to the payment of subsidies to societies and institutions where professional pauperism is indirectly encouraged and sustained. More than fifty years ago the city began to pay money to private institutions for the support of public charges. The system has grown without check until to-day New York contributes more than three times as much public money to private or semiprivate charities as all the other large cities in the United States combined. The amounts so appropriated in 1898 by some of the chief cities were: Chicago, \$2,796; Philadelphia, \$151,020; St. Louis, \$22,579; Boston, nothing; Baltimore, \$227,350; Cincinnati, nothing; New Orleans, \$30,110; Pittsburg, nothing; Washington, \$194,500; Detroit, \$8,081; Milwaukee, nothing; New York city, \$3,131,580.51.

No serious attempt has heretofore been made to reform this system of using public funds for the subsidizing of private charities. One reason for this has doubtless been the fact that until recently the local authorities were powerless to avoid or modify the effects of mandatory legislation which has disposed of city moneys without regard to the opinions entertained by the representatives of the local taxpayers. It has always been easier to pass a bill at Albany than to persuade the Board of Estimate and Apportionment of the propriety of bestowing public funds on private charities, and the managers of private charities seeking public assistance have therefore generally proceeded along the line of least resistance. The effect of this system was to make beneficiaries the judges of their own deserts, for the bills presented by them to the Legislature were usually passed without amendment or modification, and gross inequalities in disbursing public funds have arisen, different institutions receiving different rates of payment for the same class of work.

In 1890 the city paid for the support of prisoners and paupers in city institutions the sum of $1,949,100, and for paupers in private institutions the sum of $1,845,872. In 1898 these figures had increased to $2,334,456 for prisoners and public paupers, and $3,131,580 for paupers in private institutions. Private charity, so called, has prospered at the expense of the city until in some cases it has become a matter of business for profit rather than relief of the needy. The returns made by institutions receiving appropriations in bulk from the city treasury show that many of them are using the public funds for purposes not authorized by the Constitution. The Constitution authorizes payments to be made for "care, support, and maintenance." The reports of a large number of institutions show the money annually obtained from the city carried forward wholly or in part as a surplus. Different uses are made of this surplus, none of them, however, authorized by law or warranted by a proper regard for the interests of the taxpayers. In some cases this surplus is used to pay off mortgage indebtedness, in others for permanent additions to buildings, or for increase of investments and endowment. In one case the manager of an institution frankly explained a remarkable falling off in disbursements (so great that its charitable activities were almost suspended) by stating that it was proposed, by exercising great economy for a number of years, to let the city's annual appropriations accumulate into a respectable building fund. The flagrant nature of this abuse is so apparent that comment is unnecessary.

Appropriations for dependent children have reached enormous proportions. Out of a total of $3,249,623.81 appropriated for private charities in 1899, no less than $2,216,773, or sixty-nine per cent, is for the care and support of children. In no city in the United States will the number of children supported at the public expense compare, in proportion to the population, with the number so cared for in the city of New York. This may be partly accounted for by the extremes of poverty to be met with in the metropolis, especially among the foreign-born population, where the struggle for existence is so severe as to weaken the family ties; partly by the rivalry and competition which have existed between the several institutions devoted to this kind of work; partly by reason of the fact that the rate paid by the city for the care of these children is such as to enable the larger institutions, in all probability, to make a small profit; but, to a considerable extent, also from an insufficient inspection by public officers for the purpose of ascertaining whether children are the proper subjects of commitment and detention. In the city of New York 50,638 children in private institutions are cared for at the public expense. This is one to every sixty-eight of the estimated population of the city.

So much for the abuse and extent of public charity. Now for the reforming of the system that was fast approaching the condition of a grave scandal. The last Legislature passed a bill placing in the hands of the local Board of Estimate absolute power over all appropriations for charitable purposes, and for the first time in many years reform is possible. The discretion conferred by this act upon the Board of Estimate and Apportionment carries with it a large responsibility. If hereafter the city, in its relation to private charitable institutions, should either, on the one hand, be wasteful of public funds, or, on the other hand, should fail to perform the duties owed by the community to the dependent classes, the blame can not be shifted to the Legislature, but will rest squarely upon the shoulders of the local authorities.

In treating a condition which has been allowed to exist for many years almost without challenge from the local authorities, and which has grown upon the passive or indifferent attitude of the public, sweeping and immediate reforms can be instituted only at the cost of serious temporary injury to certain charitable work of a necessary character. I believe that the best results will be obtained if the city authorities first decide clearly the relations to be established between the city treasury and private charitable institutions, and then move toward that end by gradually conforming the appropriations in the budget to that idea, in such a manner that progress shall be made as rapidly as may be consistent with the desire to avoid crippling excellent charities which have been led to depend for many years upon public assistance. By this, of course, I do not mean to suggest that we should approach the subject with excessive timidity, for the evils that exist have assumed such proportions that a more or less severe use of the pruning knife must be made in dealing with appropriations, else the effect will be scarcely perceptible. I am convinced that ultimately the cause of charity will benefit rather than suffer from this course, for it is a serious objection to the whole subsidy system that it tends to dry up the sources of private benevolence.

In making up the budget for 1900 I shall urge my associates in the Board of Estimate to agree with me to limit the appropriations for charity to actual relief work accomplished. The giving of public money in lump sums to private societies and institutions for miscellaneous charitable work, of which there is no public or official inspection, should be discontinued at once. It has been the practice for some years past, both in Brooklyn and New York, to donate annually lump sums of money to such organizations. In New York these amounts have been for the most part comparatively small, and principally derived from the Theatrical and Concert-License Fund. In Brooklyn the amounts have been larger, and were obtained originally from the Excise Fund, and later directly from the budget. This practice should be wholly discontinued. The charter itself contains stringent prohibitions against the distribution of outdoor relief by the Department of Public Charities, and the spirit of these provisions would certainly seem to disfavor accomplishing the same result in an indirect manner. Many of these recipients of public funds devote themselves exclusively to outdoor relief, and an examination of the purposes of some of these organizations shows that, however proper these may be as the result of private benevolence, they are extremely improper objects of the public bounty. The immediate and permanent discontinuance of appropriations to all such societies and institutions will correct one of the gravest abuses of the present system. If the persons conducting these miscellaneous charities are really sincere, and believe that they are doing good, they can readily obtain from private sources the funds necessary to carry on the work.

I shall urge that all appropriations to institutions of every kind not controlled by the city be limited to per-capita payment for the support of public charges, and that a system of thorough inspection be at once established to ascertain if present and future inmates are really persons entitled to maintenance at public expense. In addition to this precaution, the comptroller should have full power to withhold payments to any institution after an appropriation has been made if in his judgment, after examination, the money has not been earned. The payment of city money to dispensaries should be discontinued, except in special cases where the work done is clearly a proper charge against the public treasury. No money should be paid for the treatment of dependent persons in any private hospital while there is unoccupied room in the city hospitals.

The city maintains its own hospitals, while at the same time subsidizing private institutions which compete with them. During the last few years great improvements have been made in the city hospitals, but their condition is still capable of considerable further improvement. While sometimes overcrowded, it frequently happens that the city hospitals are not filled to the limits of their capacity, and it would seem as though the city should not deal with private hospitals except as subsidiary aids or adjuncts to the public institutions. It stands to reason that so long as there are vacant beds in the city hospitals and the city is at the same time subsidizing private hospitals at a cost greater than the expense of caring for patients in its own institutions, a wrong is being done to the taxpayers. If private hospitals are to receive public assistance at all, payments should be made only at some uniform rate, approximately the same as the cost per capita of maintenance in the public institutions.

The gravest problem of public charity is the support and training of dependent children, because that has to do with the making of future citizens of the republic as well as the relief of immediate suffering. This work is entirely in the hands of private societies and institutions. The rearing of large numbers of children in either private or public institutions is in itself an evil—a necessary evil—and likely to continue as long as there is extreme poverty, but still an evil, and not to be fostered by subventions of public money in unnecessary cases, when parents are really able to provide for their support.

To build, equip, and maintain public buildings for the care of dependent children seems to me entirely impracticable. Regardless of the matter of expense, which would be enormous, all the disadvantages of the "institutional system" would continue, and it is not likely that public employees could be obtained who would rear children as economically, as efficaciously, or with the same devotion and self-denial as is the case with the religious orders and associations now performing this work—in many respects so successfully. The care of these children by direct governmental agencies being therefore practically impossible, in the city of New York at least, and it being recognized that the present system is likely to continue for many years, if not permanently, the most should be made of it. With the religious training of children the city has nothing to do. Their moral training may also be left safely to those now responsible therefor. On the other hand, the State is vitally concerned with their mental and physical development, and visitation and control for the purpose of maintaining a proper standard in these respects is essential. This form of public charity, like many others, has been abused, and many children are now supported in institutions who probably should not be there. For the rearing of a child into a possible useful man or woman a poor home is better than a good institution, and it is the duty of the city authorities to extend the work of inspection and investigation of such cases until they make it impossible for fraud in the commitment and retention of children to escape detection.

The reduction and regulation of appropriations as outlined can not be classed as a radical reform, and will work no hardship upon any dependent person who is a proper charge upon the city. The saving to the taxpayers, if the plan I have suggested is adopted, will approximate one million dollars in 1900, and a steady reduction of expenditures for charitable work should continue for several years to come.

CHRISTIAN SCIENCE FROM A PHYSICIAN'S POINT OF VIEW.

By JOHN B. HUBER, A. M., M. D.

CHRISTIAN SCIENCE is stated to be a religious system which was "discovered," in 1866, by Mrs. Mary Baker G. Eddy, a lady now living in the vicinity of Boston, Mass., who has passed her eightieth year, and who is called by her followers the "Mother of the Christian Science Church," or "Mother Mary." Mrs. Eddy has formulated Christian Science in a book entitled Science and Health, with Key to the Scriptures, in which book are to be found the principles upon which this system rests. We are told that to him who studies this book reverently and conscientiously there will be revealed "the Truth," for which man has been searching without avail since the beginning of his existence; that the faithful student will find in Christian Science an infallible guide for the conduct of life in all its phases; and that the Christian Scientist has the power to heal without any therapeutic means, other than that of the influence of mind upon mind, all imaginable ills, surgical or medical, which afflict mankind and the lower animals. Mrs. Eddy tells us that she and her followers have had this power transmitted to them from Jesus Christ, and that they are able to heal the sick and to perform miracles as He is said to have done. In Science and Health all religious systems other than "Christian Science" are held to have been erroneous and pernicious in their influence upon mankind, and the practice of medicine, as it is taught in the medical colleges, is considered to be hurtful rather than helpful to humanity, and to have increased disease rather than ameliorated human suffering.

It is said that in 1898 there were in the Greater City of New York three thousand Christian Scientists and seven Christian Science churches. The whole number of Christian Scientists is declared to be one million, of whom one hundred thousand, it is said, are engaged in the business of "healing," and are called "healers." The movement has been and is spreading day by day.

In religious matters Christian Science has divided many homes, and has destroyed not a few through the mischief produced by its propaganda. It is claimed that Christian Science has cured many who have not been benefited by the efforts of regular practitioners of medicine. On the other hand, many have died during the exclusive ministrations of Christian Scientists. Moreover, Christian Science considers itself entitled to disregard such sanitary laws, including those concerning infectious diseases, as have been found effectual to preserve intact the general health of communities and peoples.

Christian Science, then, is a cult unusually powerful and far reaching in its influence, and it is therefore entitled to and should invite correspondingly careful investigation of all its various aspects.

I have been interested in Christian Science from the viewpoint of the medical man, and I have felt quite unaffected, for the reason which I shall presently give, by Mrs. Eddy's stricture that "a person's ignorance of Christian Science is a sufficient reason for his silence on the subject." The system of medicine, as it is taught in the great medical colleges of to-day, is an epitome of the accumulated study and experience of mankind from the time human beings first became ill up to the present day. All systems of cure, or of alleged cure, have been examined by men who have made it the work of their lives to treat the sick. Whatever has been found curative has been retained, and unsubstantiated claims to cure have been discarded; so that the regular degree of doctor of medicine states that its recipient has acquired a knowledge of the system of treating disease which is a crystallization of the world's best medical thought, study, and experience.

As the possessor of such a degree, I have been engaged during several months in an investigation of the cures which Christian-Science healers are said to have accomplished.

Before beginning this work I reflected that mental suggestion, or the influence of the mind of the physician upon that of the patient, is a potent factor in the treatment of such diseases as are not characterized by permanent pathological changes in the tissues, and I remembered that when judiciously influenced by the physician's mind, the mind of the patient can affect his body favorably both in functional disorders and in disorders which may result from nervous aberration—such as hysteria in all its protean forms, the purely subjective, as headache and hyperæsthesia, and also those exhibiting objective manifestations, as hysterical dislocations and paralyses.

I knew that medical men, in their own unadvertised work, employ mental suggestion as a therapeutic means, rely upon it as a part of their armamentarium, and use it in appropriate cases, either alone or combined with other means of cure, as electricity, hydrotherapy, and drugs—which last, despite Mrs. Eddy's foolish denunciation, are quite as much entitled to be considered divinely appointed therapeutic agents as is mental suggestion.

What I did want especially to discover was whether the Christian Scientist could cure such diseases as are considered by the medical man to be incurable—as cancer, locomotor ataxia, or advanced phthisis—and also what were the results of their treatment of typhoid fever, pneumonia, diphtheria, malaria, etc. And I wanted also to investigate the claims of Christian Science concerning the alleged cure of surgical conditions, such as necrosis or hæmorrhage from severed arteries, by no other means than the sole exercise of thought. If the Christian Scientist could have healed in such cases, I for my part would have declared him a worker of miracles. Therefore I searched diligently for such cases.

In the beginning I had the honor to meet Mrs. Stetson, the "pastor," or the "first reader," of the "First Church of Christ, Scientist," at 143 West Forty-eighth Street, New York city. I had prepared a number of questions concerning Christian Science which I wished to ask Mrs. Stetson. She preferred, however, not to answer them herself, but told me that she would be pleased to forward them to Mrs. Eddy. I then wrote out these questions and put them, together with a letter to Mrs. Eddy, very respectfully requesting her consideration of them, in Mrs. Stetson's hands. Mrs. Stetson then very kindly forwarded them to Mrs. Eddy. Among the questions which I asked were the following:

Is the treatment of the sick a part of Christian Science?

Upon what principles is the Christian Scientist's method of treatment founded?

How do you define health?

How do you define disease?

When a patient presents himself to you, do you inquire concerning the causes of his illness?

Do you investigate symptoms? (Symptoms, I stated, are the signs of disease.)

Do you make diagnoses? (A diagnosis, I stated, is a consideration of symptoms by which one disease is distinguished from another or others.)

In what does your treatment consist?

In treating a patient, do you administer any material substance, and require that it be taken into the body as one would food?

Do you consider cleanliness, good order, and the attainment of æsthetic effects in a patient's environment a part of treatment?

Do you take any steps to isolate the patient sick of an infectious disease, or to protect those about the patient from the disease?

Do you treat structural diseases, as cancer or locomotor ataxia? Do you consider you have cured such diseases? If so, how do you know you were treating a structural disease, such as cancer or locomotor ataxia?

Would you treat cases of fracture of bones or violent injury? If so, what would you do in such cases?

Will you give me the names of patients whom you have treated, with permission to inquire concerning their illnesses, your treatment of them, and the effects of your treatment upon them—upon the distinct understanding that their names are not to be published?

Do you deny the existence of matter? In Science and Health it is stated that "all is mind, there is no matter." How is it possible, in treating disease, for you to separate mind from matter?

Animals sometimes become sick; could they be cured by Christian-Science methods?

From Mrs. Eddy I received no answer nor any communication whatever. But, some time afterward, Mrs. Stetson informed me that the matter had been turned over to Judge Septimus J. Hanna, Mrs. Eddy's "counsel." Just here I reflected how Jesus Christ, whose representative Mrs. Eddy declares herself to be, would have acted under those circumstances, and I wondered how he would have appeared in this odd atmosphere hedged about by "counsel" and other legal paraphernalia. Presently thereafter I had the honor to receive a note from Mrs. Stetson, appointing a time for me to call. When I did this, Mrs. Stetson gave me a letter which had been sent her by Judge Hanna, and which she permitted me to use as I should see fit. This is the letter:

"BOSTON, MASS., *November 18, 1898.*

"*Editorial Office of The Christian Science Journal, Mrs. A. E. Stetson, New York City:*

"DEAR SISTER: Mr. Metcalf handed me the questions submitted by Dr. Huber. I have also received and carefully read your letters. As I think Mr. Metcalf has informed you, this matter was referred to me from Concord. I have been so very busy that I have not had time to give this matter the thorough attention it needs until now.

"I have carefully read and considered the entire paper. My conclusion is that it will be wholly impractical—indeed, I may say impossible—to answer these questions in such a manner as to make an entire paper fit for publication in a medical journal, or in any other magazine or periodical. The questions submitted touch the entire subject of Christian Science, both in its theology and therapeutics. These questions can be answered only in one way so that they can be understood, and that is by just such study of the Bible and Science and Health with Key to the Scriptures as the earnest, sincere Christian Scientists are giving them every day of their lives, and have been for years. When we think of the helps provided by our leader, the Rev. Mary Baker Eddy, for her own students in arriving at a correct interpretation and putting in practice the teachings of these text-books, such as the publications established by her, the Bible Lessons made up of selections from the Bible and our text-book, constituting the sermons for our service in all the Christian-Science churches; the many auxiliaries she has published and is publishing in further illucidation of the text-books —when we stop to consider that even those of her students who may be considered the most advanced are as yet infants in the understanding and ability to demonstrate the truth contained in these text-books, can we not easily see, and will not your friend the doctor at a glance see, the utter futility of attempting to answer his questions so as to make the answers intelligible to the medical profession and their readers? I admire greatly the kindly spirit manifested by the doctor and those for whom he is acting,* and the entire fairness, from their standpoint, of the questions submitted, but this does not relieve the difficulty of the situation. I therefore return the doctor's questions, with many thanks in behalf of our leader and the cause for the impartial spirit manifested.

"Yours in Truth,

"S. J. Hanna."

I wrote Judge Hanna a note of thanks, and in reply received a letter in which he stated: "I should have been very glad if I could have seen my way clear to answer your questions in such a way as could have been intelligible and satisfactory. But it was impossible for me to do so."

Now, all this seems to me much worse than preposterous. I fail utterly to see why he who asks the question, "Do you isolate a patient suffering from an infectious disease?" would have to spend months or years in Nirvana-like abstraction before he would be able to appreciate an answer to it. No doubt Judge Hanna, who is evidently a lawyer, could, if he chose, tell the reason why.

To all who had been "healed in Christian Science" whom I

* I had arranged with the editor of the New York Medical News for the publication in that journal of a paper on Christian Science, and had so informed Mrs. Stetson.

met I stated plainly my object—to investigate how they had been "healed." I stated that my findings would be published, but that no names would be printed. The cases were to be numbered. I stated that I did not wish to examine nervous manifestations of a hysterical sort or purely functional disorders. I wished to see cases of disease in which the structure of the organs was likely to be or to have been involved, such as Bright's disease or cancer. Having, to begin with, explained this fully, I took the subject's history and ascertained whenever possible the name of any physician who may have treated the patient before he or she went "into Christian Science." Almost all these physicians who live in New York I visited; to the others residing in New York and to those living out of town I wrote, the form of the letter being generally as follows:

"Dear Doctor: I am investigating Christian Science from the physician's view-point, and am examining a number of people, in the hope of presenting some twenty histories. These histories would, I think, be valuable only in so far as they are scientifically accurate. Therefore, whenever possible, I request a medical account from any physician who may formerly have been in attendance. I have now under observation the case of Mr. X——, who believes himself to have been cured 'in Christian Science.' I would thank you very kindly if you would send me whatever medical information you can concerning this case, with records of examinations if possible. The cases will be numbered, not named."

In each case, having set down the subject's statements and the physician's statement, I recorded my own observations of the subject's condition.

I examined in succession *and without exception* the case of every willing Christian Scientist up to the number of twenty.* All these cases were of their own choosing; no doubt, then, they would be considered to be among their "good" cases. Their "failures" I had no opportunity to examine. There were many others who refused to testify, no doubt justifiably. Others refused for reasons not easily comprehended, considering the fact that these people hold weekly "experience meetings," in which they "rejoice to testify to the power of Christian Science." It is difficult to see, therefore, why such cases should not invite scientific investigation.

I could find in all these twenty cases no "cure" that would

* These medical histories are a part of my serial paper in the New York Medical News of January 28, 1899, *et seq.*

have occasioned the medical man the slightest surprise. What did surprise me was the vast disproportion between the results they exhibited and the claims made by Christian-Science healers. One of these cases may be cited as an example of the loose generalization upon which many of the claims of these healers rest. A lady stated that she had had pneumonia. I asked how she knew she had had pneumonia. She declared she knew, because her nurse "could tell at a glance she had pneumonia." No medical examination had been made. I asked what symptoms she had had—how she had suffered. She told me she had purposely forgotten—she had tried to dismiss from her mind all recollection of this distressing illness. Well, this is no doubt commendable enough; but how do we know, then, if she really had pneumonia, or anything more than an ordinary cold?

I heard during my investigation of cases of yellow fever, phthisis, cancer, and locomotor ataxia which had been "healed in Christian Science." But truth compels the statement that my efforts to examine these cases were defeated by the cheapest sort of subterfuge and elusion. To be explicit: On November 2, 1898, a man arose in an "experience meeting" which I attended and stated that he had been one of a party of twelve who, while in Central America, contracted yellow fever, he having suffered with the rest. All took medicine but himself; instead, he read Science and Health. Among his companions seven died; he recovered completely. Several days later I called at the church and asked for the name and address of this gentleman, and twice, on this and a subsequent visit, the clerk promised to send me his address. Not having received it, I called a third time, on November 21st. The clerk told me he could not find this eel-like specimen, and could not get his address. This man was, however, a member of that church, and had, on the evening I was present, a number of acquaintances in the congregation.

Again, I had been told that a young lady living out of town had been "healed" of consumption. I wrote her mother, who sent me a kind note, inviting me to call several evenings later, and inclosing a time-table. She stated, "I shall be happy to give you any information in my power, as Christian Science has been a great blessing in my family." Before the appointed evening I received a note, breaking the engagement. Again, at an "experience meeting" a man arose and declared he had cured a case of locomotor ataxia, "so that the patient's two former physicians had been lost in amazement at the change." I learned also that his wife, another "healer," had cured a case of cancer of the tongue. I wrote this gentleman, and he sent me an answer, kindly inviting me to call at his house. He lived out of town. I went to his house, and spent the greater part of an evening trying to prevail upon these two people to show me or to introduce me to these subjects of locomotor ataxia and cancer of the tongue. They utterly refused to do so. Their line of argument was quite of the same sort as that contained in the letter of their better-known "brother in the church," which appears earlier in this paper. I was not investigating in the right way. What I ought to do was to study Science and Health and the other elucidatory works—above all with an obedient spirit, and "the truth" would come to me in time. Or it may be this pair of "healers" had in mind this reasoning, not new in my observation of this odd cult: In the mind of the Christian Scientist the locomotor-ataxia patient was healed, but he was withheld from inspection by the deceptive senses of those outside the Christian-Science pale, to which senses the patient might appear to stagger about and be as ill or more ill than ever before. Following is this "healer's" letter to me:

"My dear Dr. Huber: I received your letter with Joy, and name next Monday eveng as a time to give you for your enquiry into the workings of Truth as it has come under my notice. Our field is a broad one coverig several towns, and we have not lately had an eveng free for discussin the subject coverig this sublime and stately Science That leads into all Truth even to the solving of the problem of Being. The healing of the sick is only the primary steps this step however is an important one as its demonstration with proof attests its divine origen even God—Good, its principle source and ultimates in Eternal Life. For the Life is in his Son and Divine Science reveals this son Even our own Christ our spiritual Individuality God being our Father and mother,

"Yrs. in Truth

"———."

The writer of this letter is the leader of that Christian-Science church in New Jersey a member of which was a woman who died, in June of this year, of consumption,* and this woman's "healer" was the writer's wife. The woman who died left the Episcopalian Church and became a Christian Scientist in January, 1899. In April she contracted a heavy cold, to which she gave no attention. Her husband remonstrated with her, and wished her to consult a physician, but she would not do so. She declared she could not be ill, but that she was well and happy. The services of her "healer" were the only ministrations she received. In the be-

* New York Times, June 24, 1899.

ginning of June her condition was so bad that her husband prevailed upon her to see a physician, who examined her and found her hopelessly ill with consumption. Another physician examined her and reached the same conclusion. She then turned "longingly and earnestly to the religion in which she had been brought up." Two weeks after, she died, "asking the prayers of her co-religionists in behalf of herself, her husband, and her children."

Mrs. Eddy declares that she "healed consumption in its last stages, the lungs being mostly consumed"; that she "healed carious bones which could be dented with the finger"; and that she "healed in one visit a cancer that had so eaten the flesh of the neck as to expose the jugular vein so that it stood out like a cord." Judge Hanna has published statements to the effect that "cancer, malignant tumors, consumption, broken bones, and broken tissues have been healed in Christian Science, without the assistance of any material means whatever." Mr. Carol Norton, a Christian-Science lecturer, has publicly announced that Christian Science has healed "locomotor ataxia, softening of the brain, paresis, tumor, Bright's disease, cancer," etc. And many other Christian Scientists have made like claims. Very well, then. Who are these people that have thus been cured? What are their names? Where do they live? How can they be found? Will Mrs. Eddy and her followers submit these cases for scientific examination? I and other investigators are asking, and have for years been asking, these questions, and we are all of us still waiting for answers.

The importance of all this is no doubt manifest. The healing of disease is, we are told, the outward and visible evidence upon which Christian Science expects to be judged and accepted. Therefore the cult must stand or fall upon the results of an investigation of the healer's claims. "By their fruits ye shall know them."

There are Christian Scientists who will say that these statements of Mrs. Eddy and her associates must be taken upon faith and as *ipse dixit* utterances. This is in the last degree silly. With such statements faith has absolutely nothing to do. They are solely matters for scientific inquiry.

Every Christian Scientist may be a healer. A little child may be a healer in Christian Science. The treatment is said to consist in thinking, speaking, and writing. It is declared that no material substances are used. The following oddity in mental processes is here to be noted: A healer told her patient to take a certain drug during her illness, and that she would then demonstrate the power of Christian Science *over this drug.*

The healer does not need to see his patient. He may, if he will, treat "absently," by a species of thought transference. He would consider his treatment effectual if he were in New York and his patient were in Hong Kong.

I have rheumatism, let us say, and at midnight my swollen and inflamed joint gives me pain. I send for a Christian-Science healer. In all probability my messenger will call upon a person who has had no preliminary medical education whatever. He is likely to find some one who is quite illiterate, as witness the letter last presented. He may, as I have, come upon some one who has been engaged in the occupation of amusing the *habitués* of beer saloons by playing upon the zither before he took up the more remunerative business of Christian-Science healing. Or he may, as I have, come upon some one who is engaged simultaneously both in the business of selling drugs and in the practice of healing by mental therapeutics alone.

Having been found, the healer, first requiring a fee from my messenger, treats me "absently," while lying abed in his own home. His treatment consists in sending me word that I only imagine I am ill, that my joint is really not swollen, that it is really not inflamed, and that it really does not pain me, but that, on the contrary, I am really very well and very happy indeed.

Some diseases are in Christian Science considered to take longer to heal than others; I have not understood why. If "all is mind, and there is no matter," * as the Christian Scientist holds, and if, therefore, the varying densities of tissues need not be considered, why should not cancer or locomotor ataxia be healed as easily and as rapidly as a headache or a hysterical manifestation? Christian Science despises bodily cleanliness, the use of baths, and the most ordinary sanitary regulations. "To bow down to a flesh-brush, bath, diet, exercise, and air is a form of idolatry." † We learn, finally, that "the heart, the lungs, the brain, have nothing to do with life." ‡

Christian Science has stood by the bedside of an infant sick with diphtheria, has prevented interference with its incantations, and has seen this infant choke, grow livid, gasp, and expire, without so much as putting a drop of water to its lips.

Most Christian Scientists are well to do. Their tenet is that "no one has any business to be poor." In New York their churches are in the neighborhood of the wealthy, and there are no missions by means of which the professed blessings of Christian Science may be disseminated among the poor. Christian Science is demonstrably a powerful organization for the accumulation of wealth, and by easy calculation one may see that her propaganda has made Mrs. Eddy, who is said to have been at one time very

* Science and Health. † Ibid. ‡ Ibid.

poor, conspicuously rich even in these days of enormous fortunes. When we consider that this woman claims to be actuated by the spirit of the poor Nazarene, has hypocrisy ever gone to greater length?

Mrs. Eddy despises all metaphysical systems, yet her writings display her inability to think logically through half a dozen consecutive lines.

Mrs. Eddy declares that "no human being or agency taught me the truths of Christian Science, and no human agency can overthrow it." * But there are published statements,† of the truth of which the writer offers to give legal proof, in which it is shown, by means of the "deadly parallel," that the essential ideas underlying her system are all plagiarized from the writings of an irregular practitioner to whom, many years ago, she went for treatment. Published accounts of her illness at that time present a picture of hysteria pure and simple.

Mrs. Eddy claims to possess healing powers nothing short of miraculous, yet the writer just mentioned declares that she has probably not been a well woman these forty years past. Certain it is she almost never appears in public, and only a few of her followers have ever seen her face except in copyrighted photographs.

The medical profession is most stupidly reprobated by Mrs. Eddy and her associates, especially for its "mercenary motives." A specific statement may here be not malapropos. In the year 1895 there were 1,800,000 inhabitants in the lesser city of New York, and on the rolls of its hospitals and dispensaries were more than 793,000 names of people for the treatment of whom New York's medical men received practically no pecuniary reward whatever.

It is declared that Christian Science is a religious system, that the treatment of the sick is a part of this system, and that, as the Constitution forbids interference by the States with religion, no laws can be enacted which could compel the healer to desist from his work. But there is a sharp distinction between religious liberty and license to commit, in the name of religion, unlawful acts. A man would not be justified in killing his child in obedience to a fanatical belief, as Abraham was about to do; but Christian Science has sacrificed the lives of little children upon the altar of its pseudo-religion. Had not these children rights which ought to have been safeguarded? If the Christian Scientist's position be admitted, a thug might, upon the same principles, be justified in committing murder, on the ground that murder is a practice required by his religion; and a Mormon might, on the same basis, practice polyg-

* Science and Health.

† The Arena, May, 1898.

amy. When a healer treats for hire a sufferer from typhoid fever, is he acting in a religious capacity?

The observer will find in Christian Science much charlatanry (by which many honest fanatics are deceived), much to surprise reason and common sense, to offend good taste and the proprieties, to outrage justice and the law, and to mortify the pious.

And in the last degree reprehensible will appear this cult's ghastly masquerade in the garb of Him that prayed in the Garden of Gethsemane, "the pale, staggering Jew, with the crown of thorns upon his bleeding head," the tenderest, the divinest, the most mankind-loving personality the world has ever known.

THE WHEAT LANDS OF CANADA.

By SYDNEY C. D. ROPER.

WHEN Sir W. Crookes, in his inaugural address as President of the British Association, startled a large number of people by stating that, unless some radical change was made in the present system of wheat cultivation, there would be a bread famine in 1931, because the world's supply of land capable of producing wheat would have been exhausted, there was undoubtedly a considerable feeling of uneasiness engendered, and more attention was paid to the address than is usual even to so valuable a contribution as the inaugural address of the President of that Association must always be. It was, therefore, with a feeling of relief that we found one person after another, well qualified to speak, coming, as it were, to the rescue, and pointing out that Sir W. Crookes's conclusions were not warranted; and in the minds of the majority, no doubt, the last feeling of uneasiness was dispelled by the able letter in The Times, in December last, in which Sir John Lawes and Sir Henry Gilbert, who are *facile principes* as scientific agriculturists, and whose opinions carry greater weight than even those of the President of the British Association, gave most satisfactory reasons for being unable to believe in Sir W. Crookes's predictions.

It is true that, in a subsequent letter, Sir W. Crookes stated that his remarks were intended more as a serious warning than as a prophecy; but, seeing that his conclusions were based on definite statements of definite facts and figures, it is difficult to treat them as other than prophetic.

In order, however, to establish the probability of a wheat famine in the near future it became necessary for Sir W. Crookes to seriously misrepresent and underestimate the wheat resources of some of the principal countries most interested in producing that cereal, and it is to a large extent by exposing the magnitude of these misrepresentations that the validity of his conclusions is called in question and disproved. The two countries which, with perhaps the exception of Russia, are most concerned in the wheat production of the future, and therefore in the correction of these misstatements, are Canada and the United States.

Mr. Atkinson, the well-known writer on economic subjects, took up the cudgels for the United States, and their case could hardly have been in better hands; but so far no champion has appeared on behalf of Canada; and while Sir W. Crookes may not have been alone in his views about the possible exhaustion of the wheat area in the United States, he certainly stood quite alone when he committed himself to the remarkable statements that are to be found in the address, in order to decry the capabilities of the Canadian wheat fields. I did not immediately reply to them myself, thinking that some one better qualified would do so, but this has not been done, and as I feel that they can not be allowed any longer to remain unanswered, I propose to deal with them in the present article.

Mr. Atkinson's defense has been criticised, in the March number of The Forum, by Mr. C. Wood Davis, who naturally upholds Sir W. Crookes's views, seeing that they appear to have been largely induced by his own figures and agree with his own ideas, but his argument in that article is more one of fault finding with the statements of others than an attempt to justify his own position. As a specimen of his style of criticism, Mr. Davis takes Mr. Atkinson to task for saying that "the present necessities of the world are computed by Sir W. Crookes at 2,324,000,000 bushels," and says that in no part of his address was an estimate of the whole world's requirements so much as mentioned; and yet, on turning to the address, we find that Sir W. Crookes said: "The bread eaters of the whole world share the perilous prospect. . . . The bread eaters of the world at the present time number 516,500,000. . . . To supply 516,500,000 bread eaters will require a total of 2,324,000,000 bushels for seed and food." The requirements of the whole world are distinctly stated here, for bread is required only for the bread-eating population, and therefore the requirements of that population are, as far as bread is concerned, the requirements of the whole world. Mr. Atkinson, however, is well able to take care of himself, and he and Mr. Davis can fight out for themselves the question as to when, or if ever, the United States will cease to export wheat; but it is amusing to find Mr. Atkinson charged by Mr. Davis, of all men, with dealing in "purely speculative computations," for if there is any one who has freely indulged in these same purely speculative computations it is Mr. Davis himself, as we shall presently see.

The value of the various calculations that statisticians indulge in is largely discounted by the fact that allowance is rarely made for changing conditions. Such has been the ratio, such is the ratio, and therefore in so many years' time such will be the ratio, is the burden of their calculations, so that while their figures for the past and present may be both correct and instructive, their calculations for the future are frequently of little practical utility; and it is this failure to allow for any variation in conditions that renders Mr. Davis's figures of so little value, and Sir W. Crookes's conclusions, which are based on them, of no greater importance.

It is surprising to find how much value Sir W. Crookes attaches to Mr. Davis's figures, and it leads one to the conclusion that he has either not examined them very closely, or shares with Mr. Davis a fondness for "purely speculative computations"; and while it is not seemly to accuse, as has been done, a man of Sir W. Crookes's standing and reputation of resorting to "bucket-shop" methods to support his conclusions, it is difficult to avoid thinking that the anxiety to establish those conclusions has not only led him to accept Mr. Davis's calculations without proper examination, but has also influenced the preparation of some of his antecedent data and led him to subordinate facts as a means to a required end. Since Sir W. Crookes thinks so highly of Mr. Davis's figures and upon them has based some of the most important conclusions of his address, and as Mr. Davis himself is so ready to find fault with the calculations of others, it might be well just here to see how some of Mr. Davis's own calculations have been verified and what amount of dependence should be placed upon his figures or on deductions from them.

In An Epitome of the Agricultural Situation, published by Mr. Davis in 1890, he predicted an annually increasing deficit in the world's wheat supply and the almost immediate inability of the United States to do more than grow enough wheat for home consumption, and, as a consequence, that "After 1895 we (United States) must either import breadstuffs, cease to export cotton, or lower the standard of living," this latter prophecy being emphasized by being printed in capital letters. These predictions were made ten years ago—ample time, surely, for at least some evidence of their fulfillment to be apparent. But what are the facts? The Chief of the Bureau of Statistics, in his report on the foreign commerce of the United States for 1898, says: "The total exportation of meats and dairy products amounted in the last fiscal year (1898) to $167,340,960, against $145,270,643 in the highest year prior to that date (1894), while the value of animals exported in 1898 was greater than that of any preceding year; of wheat the exports of the year were the largest in value, save the exceptional years of 1880, 1881, and 1892. Of cotton the exports of the year were the largest in quantity in the history of the country. . . . Thus, in the great agricultural products—breadstuffs, provisions, and cotton—the exports have been phenomenally large, while the total of products of agriculture exceed by $54,000,000 the exports of agricultural produce in any preceding year of our history." So much for exports; now for the imports of breadstuffs. The total value of breadstuffs, both dutiable and free, entered for consumption in 1898 was $957,455, of which $628,775 were for imports of macaroni, vermicelli, etc., articles not in any case manufactured in the country. I have not seen any explanation by Mr. Davis of the failure of his predictions, but it is probable that he had them in mind when he wrote in The Forum (March, 1899), "Had not the herds of hay- and maize-eating animals shrunk greatly since 1892, thus rendering vast areas of hay and maize lands available for wheat production, we should probably have reduced the wheat area, instead of adding ten million acres to it since 1895." This, however, is a purely arbitrary assumption, unsupported by anything more substantial than Mr. Davis's personal opinion. In the same article he says: "But herds being insufficient for present needs must be added to in the measure of the existing deficit, as well as in that of the animal products and services required by all future additions to the population. This will necessitate and force a restoration to other staples of acres recently diverted to wheat." But, in the face of the figures quoted above, the evidence is clear that herds are not only ample for present needs, but afford a larger margin than ever of exportable surplus. If herds were insufficient, there would have been a curtailment of exports and an increase in the consumption of breadstuffs, but neither have happened; neither has there been any reduction in the standard of living. Is not the inference irresistible that the country was carrying a larger number of animals than conditions absolutely required, since farm animals have declined from 169,000,000 in 1892 to 138,000,000 in 1898, without in any way disturbing the conditions of food supply or reducing the exports of provisions? In 1890, Mr. Davis assumed that 44,800,000 acres of hay would be required in 1895 and 49,200,000 acres in 1900, yet in 1898, 42,800,000 acres were found to be ample for the needs of the country.

Do not the foregoing figures clearly indicate that it is not safe to assume that the area employed in the cultivation of certain staples at any given time, or the average of that area for any given period, must necessarily be the proportion always to be required for the cultivation of those articles, and that any calculations or predictions made on that assumption are liable to be completely upset by events unforeseen and unprovided for? Does it not seem probable that if Sir W. Crookes had examined Mr. Davis's figures more closely than apparently he did, he would have found that "average acre yields for long periods" are not "essential factors"; that "unit requirements for each of the primary food staples of the temperate zones" can not be so easily determined; that "the ratio existing during recent periods between the consuming element and acres employed in the production of each of such primary food staples" are not necessarily indicative of the ratio that will require to exist in the years to come; and that Mr. Davis's "scientific method" does not "enable him to ascertain the acreage requirements of the separate national populations and of the bread-eating world as a whole"?

In order to insure a famine in 1931 it was necessary for Sir W. Crookes to assume a given increase of population during the intervening period and no change in the existing conditions of wheat cultivation and consumption, and also to limit by hard-and-fast lines the sources of supply. It is to the manner in which Sir W. Crookes has limited and underestimated the wheat resources of Canada that we now propose to take exception; and it is difficult to understand how, with ample means of information available, he could have committed himself to the statements he has made. What does he say about Manitoba? "In the year 1897 there were 2,371,441 acres under cultivation in Manitoba, out of a total of 13,051,375 acres. The total area includes water courses, lakes, forests, towns and farms, land unsuitable for wheat growing, and land required for other crops." Now, the facts are that the total area of Manitoba is 73,956 square miles, and if from that area 9,890 square miles of water surface are deducted there remain 64,066 square miles, or 41,002,240 acres of land, so that even after making due allowance for forests, towns, etc., there are nearly three times the number of acres available than are given by Sir W. Crookes. Attempts have been made in vain to find out whence these figures were obtained, but there is apparently no clew; and while it is not to be supposed for a moment that the figures were purposely misstated, surely the important conclusions drawn from them deserved that some attempt at least should have been made to ascertain their accuracy. Sir W. Crookes claims to be indebted to the official publications of the Government of Canada, but it is certain that none of them ever contained the figures used by him.

"The most trustworthy estimates," says Sir W. Crookes, "give Canada a wheat area of not more than six millions of acres in the next twelve years, increasing to a maximum of twelve millions of acres in twenty-five years." Who prepared these estimates, and upon what are they based? Were they prepared by the same authority that supplied Sir W. Crookes with the figures of the area of Manitoba? If so, we may well dismiss them at once; but supposing that these estimates are, as far as the rate of increase is concerned, perfectly correct, and that the wheat area of Canada will be only twelve million acres in twenty-five years, there would still remain at least twelve million acres in Manitoba alone available for wheat. It is no exaggerated estimate to say that from sixty to seventy per cent of the land available for cultivation in Manitoba is well adapted for the production of wheat. Sir W. Crookes says that his area of Manitoba of 13,051,375 acres includes water courses, lakes, forests, towns, etc. Now, the water area alone of Manitoba is 6,329,600 acres, so that after deducting this area and the 1,630,000 acres already under wheat and making due allowance for the other conditions mentioned, he would have us believe that wheat-growing in Manitoba has already nearly reached its limit, which all who know anything about the province will unite in saying is absurd.

Now let us turn to the Northwest Territories, where, according to Sir W. Crookes, there is practically no amount of land of any consequence available for wheat, and let us remember that the same authority limits the wheat area of Canada to a maximum of twelve million acres. The area of the three provisional districts, with which alone we will deal, is as follows, viz.: Assiniboia, 57,177,600 acres; Saskatchewan, 69,120,000 acres; and Alberta, 63,523,200 acres (these figures being exclusive of water surface), making a total of 189,820,000 acres. Some of this large area is possibly not particularly well adapted for agricultural purposes, but a careful examination of all available data on the subject justifies one in saying that fully one half is suitable for successful wheat cultivation, while in eastern and southern Assiniboia there are some 20,000,000 acres, in the valley of the Saskatchewan 14,000,000 acres, and in northern Alberta 15,000,000 acres that are especially adapted for the production of wheat as a staple crop. The area is so large and settlement at present so sparse, that it is impossible to do more than give its capabilities in general terms, founded on the opinions of experienced men who have traveled over it. Professor Saunders, Director of the Experimental Farm at Ottawa, than whom there is no better authority on the subject in the Dominion, told me that, from what he saw of the country in driving over it, he became more and more impressed every year with the vast area of good land in the Northwest, and no practical man has ever traveled through those regions but has been amazed at the prospect of their capabilities.

But we have not yet reckoned with the rich and fertile province of Ontario. This province has a land area of 140,576,000 acres, of which 11,888,853 acres were under cultivation in 1898, and of this latter quantity 1,437,387 acres, or twelve per cent, were in wheat, being an increase of 163,860 acres over the wheat area of 1897, and of 62,573 acres over the average of 1882–'98. According to the census of 1881 there were nearly 2,000,000 acres in wheat in 1880, but, under the influence of an unremunerative market, the area declined year by year until in 1895 there were but 967,156 acres so employed; since then, however, stimulated by a more profitable price, the area has increased by 470,471 acres, and an increase of twenty per cent upward is reported in the area for 1899. Fall wheat in this province is a very successful crop, having averaged in the last two years twenty-five bushels and twenty-four bushels per acre respectively, while the average for the period 1882–'98 has been 20.5 bushels per acre, so that nothing but a continuance of good prices is needed to largely increase the production of wheat in Ontario. In no part of the province, where agriculture is possible, has wheat failed to grow, but the area is so large that it would be unwise to put into figures the extent available for wheat cultivation, it being sufficient to show that a very large portion, if not indeed the whole, of the twelve million acres to which Sir W. Crookes has limited Canada could, other conditions being favorable, be supplied by Ontario alone.

The "trustworthy estimates" quoted by Sir W. Crookes limit, as has been stated, the wheat area of Canada to a maximum of twelve million acres under cultivation in twenty-five years; whence the estimates were derived or on what grounds they are entitled to be considered trustworthy there is no information; but is it of any consequence? Let them come from whatever source they may, are they not perfectly useless? The progress of wheat cultivation during the next twenty-five years does not depend upon any mathematical ratio of progression, but on the course of certain events absolutely unknown at the present time. The point is that Sir W. Crookes adopts these estimates and gives out to the world a statement, on the strength of them, that, in addition to the 3,500,000 acres at present in use, there are not more than 8,500,000 acres in Canada available for wheat cultivation—a statement calculated, if believed, to seriously damage Canada's prospects of settlement, and a statement that is as much at variance with the actual facts as it is possible for such things to be. Is it fair to the country for a man of such high standing and reputation to make such unfounded assertions? Five minutes' real consideration of the question would have convinced him that there are more than that number of acres in the province of Manitoba alone. The figures already given, which have been prepared from the most reliable available information, go to show that there are upward of seventy-five million acres of land in Canada especially adapted for the production of wheat, and this estimate is confined to those portions of the country which may be considered as essentially wheat-producing areas; and no account has been taken of the vast extent of land, not only in the provinces of Ontario and Manitoba and in the Northwest Territories, but also in the otherwise unnoticed provinces of Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and British Columbia, that is not only suitable for the production of wheat, but on which a large quantity of wheat will undoubtedly be grown, which, entering into home consumption, will increase the exportable surplus.

I am well aware that there are a number of people who will say that my figures underestimate the resources of the country, but I would rather that it were so than indulge in figures that seem too extravagant to be realized; and if, in the future, it appears that the wheat area is larger than I have stated, then so much the better for Canada. I do not mind how much evidence can be brought to increase my figures, as long as I am satisfied that they can not be truthfully reduced.

It is not intended to accuse Sir W. Crookes of deliberately misrepresenting Canada, but rather of almost criminal carelessness in the preparation of his case; but it is intended to accuse Mr. C. Wood Davis of the former offense and of intentionally garbling extracts from an official handbook issued by the Canadian Minister of the Interior in order to decry that country's wheat-bearing capabilities. By taking a line here and there which seems to serve his ends, and by leaving out everything that would have a contrary tendency, Mr. Davis, in his article in The Forum, makes it to appear that, according to the Minister of the Interior, the greater part of the Canadian Northwest is not only incapable of producing wheat, but is actually unfit for settlement, and summarizes his extracts by saying, "Available data do not show that any part of the Canadian districts named, except southern Manitoba and the eastern half of Assiniboia, is adapted to wheat culture, while they do show that over the greater part of these vast regions neither summer heats nor rainfalls are sufficient." This statement is false in every particular. The official handbook from which Mr. Davis professes to quote says of Manitoba that there are thirty-seven million acres available for active farm cultivation, giving therefore no warrant for the limiting of the wheat area to the southern part of the province. Mr. Davis quotes a line here and there about southern Albèrta in order to convey the impression that that part of the country is good for nothing, whereas, while it is essentially a ranching and dairying country, producing a most luxurious and nutritious growth of native grasses, with a bountiful supply of water for irrigation purposes, by which means most satisfactory crops of grain and fodder are produced, it has never been contended that it is particularly well adapted for wheat-growing; but, on the other hand, Mr. Davis carefully omits all mention of northern Alberta, and has no room for the following remarks about it which appear on the same page of the handbook: "Northern Alberta is essentially an agricultural district; . . . the principal advantages of the district will insure settlement by immigrants who desire to engage in grain farming. . . . The rainfall in northern Alberta during the summer months is sufficient to insure good crops." Concerning the district of Saskatchewan, Mr. Davis quotes a remark about some of the wooded portion being unsuited to the immediate requirements of settlement, as if it applied to the whole district, and deliberately omits the following: "The southern half of the district" (Saskatchewan) "is traversed from east to west by the Saskatchewan River, and the valley of this important stream, with the country immediately adjacent thereto, has long been famed as a desirable field for immigration." With reference to precipitation, Mr. Davis has so garbled his extracts as to convey the impression that the handbook states that over the greater part of the Northwest the rainfall is not sufficient for the pursuit of agriculture, whereas what the book really says is, "So far as the Canadian Northwest is concerned, out of about two hundred million acres of land between the Red River of the North to the Rocky Mountains, available for agricultural and pastoral purposes, not more than about one fourth, or fifty million acres in all, require the artificial application of water."

Mr. Davis's attempts to prejudice the interests of the Northwest by remarks on the severity of the climate do not need serious attention; the experience of the inhabitants and the annual production of the country speak for themselves, and it is well understood that mere thermometer readings afford little indication in themselves of the nature of a climate, and that temperatures unendurable in some countries are enjoyable, salubrious, and advantageous in others. It seems difficult to believe that Mr. Davis ever wrote the following sentence, but having written it, it would be well if he would take it to heart: "Truly 'honesty is the best policy' in the employment of statistics, whether by scientists, by plain people, or by professional statisticians; while the ability to eschew bucket-shop methods, to read correctly, to state facts and to state them clearly, and to criticise with intelligence and entire fairness, is especially desirable."

Sir W. Crookes is not content with reducing Canada's wheat resources to an insignificant minimum, but he must also retard as much as possible the development even of the small area that he admits to exist, for he says: "The development of this promising area necessarily must be slow, since prairie land can not be laid under wheat in advance of a population sufficient to supply the needful labor at seed time and harvest. As population increases so do home demands for wheat." To say that prairie land can not be laid under wheat in advance of population, and that as population increases so do home demands for wheat, are mere truisms, but it is incorrect to say that therefore the development must be slow. The rate of development depends entirely upon the rate of increase of population, and that increase depends upon the price of wheat, and the area of production will increase concurrently with the demand. According to Mr. Davis—and we will assume that his figures are in this case correct—the population in the United States in fourteen years from 1871 increased forty-four per cent and the cultivated area one hundred and twelve per cent, and, if that was the case, no estimates, however trustworthy, could have provided for such results.

It has been perfectly true, as Sir W. Crookes says, that as the wheat area of Manitoba and the Northwest increased, the wheat area of Ontario and the eastern provinces decreased, but this was in consequence of the continued low price of wheat, which led the farmers of Ontario to turn their attention more and more to dairy and mixed farming, substituting hay and root crops for wheat and barley, until the province became a dairying rather than a cereal-producing country; but that this was a movement to suit the times, and that the area available for wheat is no less in consequence, is evidenced by the rapid increase in the wheat acreage in the last two years. The farmer produces what pays him best, and it is certain that before Sir W. Crookes's failure of the wheat supply comes to pass prices will have been such that every acre of land suitable for wheat and that can be spared from other uses will have been taken advantage of; and if this is not the case, then some other staple for food will have been substituted, which will necessarily change the whole economic situation as viewed at present.

It is also true that "thus far performance has lagged behind promise," but the reasons for this are the same, and in the low values we find a ready explanation of the apparent lack of progress. What inducement has the immigrant had of late years to take up land for, or the farmer to grow, wheat that he could hardly sell for the actual cost of production? And yet Sir W. Crookes would argue that because the land has not been utilized for this particular purpose the land can not be there, and that land upon which wheat once was grown, but which is now employed for other purposes, can never again be included in the wheat-bearing area.

Progress may appear to have been slow, but it has kept pace with the demand, and in any case has been considerably more rapid than Sir W. Crookes allows. He says, "The wheat-bearing area of all Canada has increased less than 500,000 acres since 1884," whereas the actual increase since 1880 has been over 1,100,000 acres, and since 1890 upward of 760,000 acres. The area under wheat in Canada in 1898 was 3,508,540 acres, so that Sir W. Crookes only allows for an increase of 2,500,000 acres in the next twelve years. Perhaps it will not be as much, but if it is not, it will only be putting the predicted day of famine still farther away, and will prove nothing more than the fact that the state of the market has not warranted any more extended cultivation.

The statements made by Sir W. Crookes about the wheat acreage in the States are as incorrect as those about Canada, for he says, in his letter to The Times of December 8, 1898, that "the whole wheat acreage in the United States is less than it was fifteen years ago," whereas the official figures for 1897 and 1898, which were before him at the time, told him that the wheat acreage in 1897 was 3,000,000 acres in excess of the average of the preceding fifteen years, and in 1898 was in the neighborhood of 5,000,000 acres in excess of any year in the history of that country. Do not the fluctuations in the wheat acreage of the United States in recent years prove conclusively that they were solely the result of the movement of prices, and had no bearing whatever on the question of exhaustion of land? Under the depressing influence of an unprofitable market, the wheat area fell from 39,900,000 acres in 1891 to 34,000,000 acres in 1895, but, under the stimulus of a substantial appreciation, increased again, in three years, to 44,000,000 acres. If, in spite of a rising and remunerative market, the area had remained stationary or shown signs of decrease, it would have been in order to call attention to the fact as indicating exhaustion; but when, in immediate response to a rising market, the area increases by leaps and bounds, the question of exhaustion becomes less and less one of actual probability, and more and more one of theoretical possibility. A precisely similar line of reasoning is applicable to the fluctuations in the province of Ontario, and goes to show just as clearly that the decrease in area has had absolutely no bearing on the wheat-producing capabilities of the province.

"A permanently high price for wheat is, I fear, a calamity that ere long must be faced," says Sir W. Crookes; but, with due deference to so great an authority, I believe that the day of a permanent high price for wheat is yet far distant. There will be appreciations undoubtedly, but the sources of supply as yet undrawn upon are so great that it will be long before those appreciations are of any prolonged duration; but in the meantime they mean periods of great prosperity to the farmer and therefore to the world. Is a higher price for wheat such an unmixed calamity, after all? Has the average consumer of wheat benefited by the low price of wheat of late years in proportion to the hardships endured by the producer? I think not. Let those who are qualified by literary and scientific knowledge point out if they will the possibility, or even perhaps the probability, of at some period in the future the time coming when there may be, if present conditions continue to exist, a scarcity in the wheat supply, and urge as strongly as they like the advisability of taking steps in good time to prevent such a calamity; but nothing is to be gained by frightening the world with predictions of evil based only on a series of unfounded assertions, mathematical calculations, and "purely speculative computations." When, if ever, the day of scarcity will come is unknown. That it is yet far off appears to be tolerably certain; but it is sufficient for the purposes of this article that it should be understood that Sir W. Crookes's statements concerning the wheat area of Canada are absolutely unreliable and incorrect, and that there are millions of acres of good wheat land waiting for occupation by the surplus population of the world, which, when under cultivation, will assist in deferring for many years the threatened day of famine.

Dr. Sven Hedin, in his account of travel through Asia, mentions as the most remarkable feature in the central region of internal drainage (in which the rivers drain into inland lakes) "the process of leveling which goes on unceasingly. The detritus which results from the disintegrating action of the weather, and the more or less mechanical agency of the wind and water and gravity, is constantly being carried down from the mountains all round its borders toward the lower parts of its depressions, and being deposited there. In this way the natural inequalities in the configuration of the ground are being gradually smoothed away." Mr. Curzon refers to the same phenomenon in the central districts of the Pamirs—the process being the exact reverse to that where the streams hew out deep ravines in their course to the sea-going river.

BEST METHODS OF TAXATION.

By the Late Hon. DAVID A. WELLS.

PART III (*concluded*).

THE universal and admitted failure of the general property tax to attain good results and the great difficulty, indeed the impossibility, of reducing it to a form in which it can operate with efficiency and an approach to justice, must lead to its abolition and the gradual substitution of other and more simple taxes. However well adapted to a community in which the taxable property was in evidence and easily assessed for purposes of taxation, it becomes antiquated, unequal, and inquisitorial in a people where credit and credit investments have been highly developed, and where the greater social activities, whether in commerce or industry, transportation or production, are conducted by corporations issuing various kinds of securities, none of which can easily be reached by a taxing authority away from the center of incorporation. To undertake to include these securities, evidences of debt, or obligations in a general property tax is to invite evasion, put a heavy inducement on concealment, and, whenever effective, to give rise to shocking inequalities of burden. The widow and orphan, whose property is in the hands of a trustee, pay the full tax; in any other direction the holder of stocks or bonds, money or notes, escapes according to the elasticity of his conscience. The very exemptions recognized by law give an opportunity for new evasions, based upon analogy or upon some technicality under which the business is conducted. Bonds of the United States, the legal-tender notes, or money are beyond the reach of State authorities for the purpose of taxation. In the same category come also all imported goods in original packages, in the possession of the importers, and all property in transit. These exemptions alone amount to thousands of millions of dollars, and the tendency has been to increase the number of items exempted. But every such exception under the law adds to the burdens of the honest taxpayer, and every evasion of taxation also renders his charge the greater. Here is not distributive justice, but concentrated injustice.

Another large proportion of the personal property owned by the citizens of the State is of the most intangible character, and in great part invisible and incorporeal, such, for instance, as negotiable instruments in the form of bills of exchange, State, municipal, and corporate bonds, and, if actually situated in other States, exempt from taxation where they are held; acknowledgments of individual indebtedness, and a number of similar matters. All property of this character is, through a great variety of circumstances, constantly fluctuating in value; is offset by indebtedness which may never be the same one hour with another; is easy to transfer, and by simple delivery is, in fact, transferred continually from one locality to another, and from the protection and laws of one State to the sovereignty and jurisdiction of some other. It is not to be wondered, therefore, that all attempts to value and assess this description of property have proved exceedingly unsatisfactory, and that nearly every civilized community, with the exception of the States of the Federal Union, have long ago abandoned the project as something wholly inexpedient and impracticable.

The differences among the States in the interpretation of residence, of the *situs* of the property taxed, are also an objection to this system and an obstacle to its application. The want of uniformity can not be abolished by enactments of law, because absolute uniformity of laws would not insure as uniform interpretation of their provisions. The rules for assessment are uniform for the officers of a State, but the returns made involve such differences in the application of the rules that one is forced to the conclusion that a misunderstanding of the spirit of the law exists, coloring differently the view of each returning officer. Discrimination against the county or municipality and discrimination against the individual are to be met at every turn. No wording of the law can eliminate this personal judgment of each assessing authority, and the supervision of the returns by State boards of equalization has introduced an even greater departure from justice, as a majority, based upon selfish interests, may be had, and its decision may readily be defended as based upon good and sufficient reasons. An appeal to the last resort, the higher courts, may produce redress against unjust assessments, but each case must be decided upon its merits, and only under very exceptional circumstances—as in the recent case at Tarrytown, New York, where striking and general, even personal, spite had been shown in the tax levy—can a number of taxpayers find it their interest to combine and carry the question into the courts for adjudication.

Imperfect in theory, the machinery of the general property tax is imperfect. With at present fully two thirds of the personal property of the State exempted from taxation by law or by circumstances growing out of its condition, or the natural depravity and selfishness of the average taxpayer, and with a large part of the other third exempted by competing nations or neighboring States, what becomes of the theory so generally accepted in the United States that in order to tax equitably it is necessary to tax everything? A very slight examination leads to the conclusion that it is the most imperfect system of taxation that ever existed; that, with the exception of moneyed corporations, it is a mere voluntary assessment, which may be diminished at any time by an offset of indebtedness which the law invites the taxpayers to increase *ad infinitum*, borrowing on pledge of corporate stocks, United States bonds, legal-tender notes, etc., all exempt from taxation; that its administration in respect to justice and equity is a farce and more uncertain and hazardous than the chances of the gaming table; and that its continuance is more provocative of immorality and more obstructive of material development than any one agency that can possibly be mentioned. A stringent enforcement only leads to greater perversions and a wider evasion. A lax enforcement does not reduce its inequalities and general want of application to actual conditions.*

The problem, then, is what taxes to introduce in place of this confessed failure of the general property tax.

There can be little doubt that the desire for greater simplicity in taxation is generally felt, and in part put into practice. The mass of various kinds of imposts, added without any system or real connection or relation one to another, has often resulted in so large a number of charges on Government account as to defeat itself. The French taxes at the end of the last century, with their added fault of inequality and injustice in distribution, led naturally to the theory of a single tax—the *impôt unique* of the physiocrats—which did not become a fact, yet registered the protest against the multiplicity and crying oppressiveness of the remains of feudal dues and fiscal experiments undertaken under the stress of an empty treasury. So it has been noted at the present time that where an opportunity has offered there is a tendency in European countries to simplify their taxes, and, as in the case of Switzerland, prepare the way for income and property taxes. It is a greater dependence on such direct taxes in place of indirect taxes that has distinguished the great fiscal changes in recent years. Germany may have wished to establish a brandy monopoly, and Russia may resort to a monopoly of the manufacture and sale of distilled spirits. But England increases her death duties, France and the United States seek to frame

* The commissioners "have no confidence in any system of inquisition or system which requires assessors to be clairvoyants; to ascertain things impossible to be ascertained by the agencies provided in the law; to ascertain the indebtedness of the taxpayer; to ascertain or know who is the owner of property at a given time that can be and is transferred hourly from owner to owner by telegraph or lightning, and that may be transported into or out of the jurisdiction of the assessor with the rapidity of steam, or that requires assessors or taxpayers to make assessments on evidence not admissible in any court, civil or criminal, in any civilized country where witches are not tried and condemned by caprice or malice on village or neighborhood gossip."

acceptable taxes on income, and Switzerland succeeds in modifying her system in the line of direct taxes.

There is an earnest movement in favor of a single tax on the value of land, exclusive of other real property connected with it. As involving a question of abstract justice the proposition has much in its favor, but it can not be denied that practical obstacles oppose its adoption. The recent commission on taxation in Massachusetts thus treats of it: "It proposes virtually a radical change in the ownership of land, and therefore a revolution in the entire social body. In this form of taxation all revenue from land alone is to be appropriated—that is, the beneficial ownership of land is to cease. Whether or not this system, if it had been adopted at the outset and had since been maintained, would have been to the public advantage may be an open question, but it would certainly seem to be too late now to turn to it in the manner proposed. In any event, it involves properly not questions of taxation, but questions as to the advantage or disadvantage of private property in land." *

If securities are to be taxed, the methods adopted should avoid a double taxation, and an attempt to reach capital outside of the State. It is evident that a State, like Massachusetts, which taxes the foreign holder of shares in its corporations as well as the shares of foreign corporations held by its own citizens, is inviting a dangerous reprisal from other States. "Wherever the owner may be, if the corporation is chartered within the State the Commonwealth collects the tax on the shares. Wherever the corporation may be, if the owner is within the State the Commonwealth also collects the tax (in theory of law at least)." If this be the best possible system, and it is supposed Massachusetts assumes it to be, general double taxation would follow its adoption by the other States. The effort to carry this rule into practice proves its injustice as well as futility. The most searching and inquisitorial methods of seeking such property will not avail to reach a good part of it, and this results in adding inequality of burden to its other difficulties. Evasion is too simple a process to be unused, and the heavier the rate of tax the greater will be the resort to evasion and even to perjury, express or implied. The fundamental cause of the failure lies in this, "the endeavor to tax securities, which are no more than evidences of ownership or interest in property, and which offer the easiest means of concealment and evasion, by the same methods and at the same rate as tangible property situated on the spot."

This inherent difficulty can be cured only by abandoning the attempt to tax directly securities or evidences of debt, representing ownership or interest in property beyond the limits of the taxing

* Report of the Massachusetts Commission, 1897, p. 74.

authority. In the case of the securities of home companies they may be readily taxed at the source, but in the case of foreign corporations it is only by methods almost revolting in their injustice and treatment of the taxpayer that even a partial success can be secured. The dependence upon the sworn statement or declaration of the taxpayer is known to be extremely faulty and to offer a premium on untruthfulness. So long as this dependence is retained in whole or in part in a system for taxing personal property, the results must be unsatisfactory. The most judicious, even if it seems the most radical, remedy is to abandon the taxation of securities. Certainly it would be well to put an end to the Massachusetts plan of taxing securities representing property outside of the State, for that involves double taxation wherever it has been possible to impose the tax. What can be reached only by methods at all times trying and difficult, and sometimes very demoralizing, should not be permitted to remain a permanent feature of the revenue system of a State.

The New York commission of 1870 proposed to limit the State taxes to a very few number of objects. That they be "levied on a comparatively broad basis—like real estate—with certainty, proportionality, and uniformity on a few items of property, like the franchises of all moneyed corporations enjoying the same privileges within the State, and on fixed and unvarying signs of property, like rental values of buildings"—such was the scheme proposed. The leading object to be attained was equality of burdens, and a second object of quite as great importance, was simplicity in assessment and collection. Granting that real estate, lands, and buildings were taxed on a full and fair market valuation, and that corporations contributed their share toward the expenses of the State, it remained to devise a tax that should reach all other forms of property that could be properly and easily assessed. This tax was to be known as the "building-occupancy" tax, and was to be levied on an additional assessment of a sum equal to three times the annual rent or rental value of all the buildings on the land.* Nearly thirty years later

* The New York commission of 1870 submitted two propositions on this point:

1. Tax the house or building as real estate separately, at the same rate of valuation as the land—that is, fifty per cent—and then assuming that the value of the house or building, irrespective of its contents, be such contents furniture, machinery, or any other chattels whatsoever, is the sign or index which the owner or occupier puts out of his personal property, tax the house or building on a valuation of fifty per cent additional to its real estate valuation, as the representative value of such personal property; or, in other words, tax the land separately on fifty per cent of its fair marketable valuation, and tax the building apart from the land, as representing the owner's personal property, on a *full* valuation, as indicated by the rent actually paid for it or its estimated rental value. Or—

2. Tax buildings conjointly with land as real estate at a uniform valuation; and then as the equivalent for all taxation on personal property, tax the occupier, be he owner or tenant

the Massachusetts commission proposed a modified form of this tax. An annual rental value of four hundred dollars was to be exempt from taxation, but ten per cent was to be levied on all rental values in excess of that amount.

"The advantages of a tax on house rentals," said the commission, "can be easily stated. It is clear, almost impossible of evasion, easy of administration, well fitted to yield a revenue for local uses, and certain to yield such a revenue. It is clear, because the rental value of a house is comparatively easy to ascertain. The tax is based on a part of a man's affairs which he publishes to all the world. It requires no inquisition and no inquiry into private matters; it uses simply the evidence of a man's means which he already offers." * If this tax were to be given it would be possible to wipe out all the tax on incomes from "profession, trade, or employment," to abolish the existing assessments on personal property. The effects would be far-reaching. If loans of money are free from taxation, the purchasing power of money in the same degree must diminish, which simply means that the purchasing power of farms and products of farms for money must to the same extent increase; hence, the borrower on bond and mortgage will not be subject to double taxation —first, in the form of increased rate of interest, and then in taxation of his real estate—and hence the farmer or landowner who is not in the habit of either lending or borrowing money will find his ability to meet additional taxation on his land increased in additional value of land and products of land in proportion as the tax is removed from money at interest. Also, the exemption of the products of farms and things consumed on farms from taxation will give a corresponding increased value to compensate for the "building-occupancy" tax. Tenants controlled by all-pervading natural laws can and will give increased rents, if their personal property is exempt primarily from taxation. The average profits of money at interest or of dealings in visible personal property free from taxation can not exceed, for any considerable length of time, the average profits of real estate, risk of investment and skill in management taken into consideration; and therefore the real pressure of taxation under the proposed system will finally be, like atmospheric pressure or pressure of water, on all sides, and by a natural uniform law executed upon all property in every form used and consumed in the State. Persons must occupy buildings and business must be

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of any building or portion of any building used as a dwelling, or for any other purpose, on a valuation of three times the rental or rental value of the premises occupied. Tenement houses occupied by more than one family, or tenement houses having a rental value not in excess of a fixed sum, to be taxed to the owner as occupier.—*Report*, p. 107.

* Massachusetts Report, p. 106.

done in buildings, and through these visible instrumentalities capital can be reached by a rule of fractional uniformity, and by a simple, plain, and economical method of assessment and collection.

This building-occupancy tax, or tax on rental value, does not preclude a supplementary tax on corporations.

Much has been said of the onerous burdens of taxation endured by individuals compared with those of corporations, and especially corporations enjoying certain rights or franchises in public streets and highways or corporations of a more or less public character. The phenomenal growth of municipalities has been one of the notable social movements of the last twenty-five years. The drift of population from the country districts to cities has increased with each year, and finds an explanation in many causes. The opportunities offered in a city for advancement are greater and more numerous; the monotony of the farm life does not keep the young at home, but drives them for excitement and profit to the great centers of population. The economic changes of a half century also have their influence. The competition of new regions, better adapted for certain cultures on a commercial scale, has reduced the profitableness of older and more settled localities, where comparatively costly methods must be resorted to if the fertility of the land is to be maintained. The wheat fields of the West narrowed the margin of profit in New England farming, while the sheep and cattle ranges of the West made it impossible for the same quality of live stock to be raised for profit in the East. Farms were abandoned, and the younger blood went West to grow up with the country, or into the cities to struggle for a living. Further, the advances in agriculture, the application of more productive methods, and the introduction of machinery have reduced the demand for labor in the rural districts, and this has led to a migration to the cities.

The result of this has been an immense development of city life, and with it an ever-increasing field for investment in corporate activities. The supply of water is usually in the city's control, but the manufacture and sale of gas, the production and distribution of electricity, the street railways, telegraph, and telephone interests are private corporations formed for profit and using more or less the public highways in the conduct of their various enterprises. A grant of a street or highway for a railway or electric-wire subway generally involves a monopoly of that use, and the privilege or franchise may become more valuable with the mere growth in the population of the cities. Assured against an immediate competition, there is a steady increment in the value of the franchise, and in the case of a true monopoly there seems to be no limits to its possible growth.

An instance of this nature is so striking in its relations and so pertinent to the present discussion that attention is asked to it. In the reign of James I water was supplied by two or three conduits in the principal streets of London, and the river and suburban springs were the sources of supply. Large buildings were furnished with water by tapping these conduits with leaden pipes, but other buildings and houses were supplied by "tankard bearers," who brought water daily. A jeweler of the city, Hugh Myddleton by name, believed something better could be done, and he proposed to bring water from Hertfordshire by a "new river." He embarked in the undertaking, sank his fortune in its conduct, and appealed to the king for assistance. James granted this aid, taking one half of the shares of the company—thirty-six out of the seventy-two shares into which it was divided. The shares that remained received the name of "adventurer's moiety." The work was completed in 1613, and water was then let into the city.

So little was the measure appreciated that its first years were troublous ones for the shareholders. The squires objected to the river, believing it would overflow their lands or reduce them to swamps and destroy the roads. The city residents adopted the use of the water slowly. The shares were nominally worth £100 apiece, but for nearly twenty years the income was only 12*s.*, or $3, per share. In 1736 a share was valued at £115 10*s.*, and by 1800 it had risen to £431 8*s.* With the first years of this century the company prospered, and its benefits were widely applied, reflecting this change in the value of its capital. In 1820 a share was worth £11,500 and in 1878 the fraction of a share was sold at a rate which made a full share worth £91,000. In 1888 the dividend distributed to each share was £2,610. Eleven years later, in July, 1889, a single share was sold for £122,800, or nearly $600,000. The nominal capital of the company in 1884 was £3,369,000, and besides its water franchise it holds large estates and valuable properties. While the actual real estate controlled by the corporation accounts for some of this remarkable rise in the value of the shares, a greater and more lasting cause was the possession of an almost exclusive privilege or franchise which assured a handsome and ever-increasing return on the investment. Had all the other property been deducted from the statement of the company's assets, there would have remained this intangible and unmeasurable right created and conceded by its charter and long usance.

A definition of a franchise has been given by the Supreme Court in terms of sufficient general accuracy to be adopted: "A franchise is a right, privilege, or power of public concern which ought not to be exercised by private individuals at their mere will and pleasure, but which should be reserved for public control and administration, either by the Government directly or by public agents acting under such conditions and regulations as the Government may impose in the public interest and for the public security." * A necessary condition, then, is a public interest in the occupation or privileges to be followed. The good will of a person or individual trader is not a franchise in this sense, though a franchise may be enjoyed by an individual as well as by a corporation, and good will may rest upon the privilege implied in the franchise.

The recognition of franchises, a species of property "as invisible and intangible as the soul in a man's body," as a proper object for taxation is now beyond any dispute. It is peculiarly appropriate as a source of revenue for the exclusive use of the State, inasmuch as the grant of franchises emanates from the State in its sovereign capacity. In the case of Morgan *vs.* the State of Louisiana, Justice Field, of the Supreme Court of the United States, said: "The franchises of a railroad corporation are rights or privileges which are essential to the operation of the corporation and without which its roads and works would be of little value, such as the franchise to run cars, to take tolls, to appropriate earth and gravel for the bed of its road, or water for its engines, and the like. They are positive rights or privileges, without the possession of which the road or company could not be successfully worked. Immunity from taxation is not one of them." † Further, the extent to which this taxation of franchises may be carried rests entirely in the discretion of the taxing power, subject only to constitutional restrictions.

The great difficulty in applying such a tax lies in the methods of reaching an understanding on the value of the franchise. How can this indefinite something be made visible on the tax books? In many instances the franchise may be regarded as inseparable from the real property of the corporation. The rails of a tramway, the poles and wires of a telegraph company, the pipes and conduits of a gas company, are real and tangible things, necessary to a proper conduct to the respective functions of the corporations. But the right to lay tracks in the public streets, to sink pipes under the streets, or to string wires overhead is as necessary a possession and as essential to the performance of what the corporation was created to accomplish. Whether this permits the franchise to be regarded as "real estate" and so offers it for taxation is a question of some theoretical interest, but of little practical importance.‡ Unless the

* California *vs.* Southern Pacific Railroad, 127 U. S., 40.

† 93 U. S. Reports, pp. 217, 224.

‡ A recent law of New York is very full on this point:

"The terms 'land,' 'real estate,' and 'real property,' as used in this chapter, include the land itself above and under the water, all buildings and other articles and structures, franchise is regarded in this way, as belonging to real estate, or as forming a taxable entity apart from other property, it would be simpler to reach it through a corporation tax in one of the many ways open for applying that tax.

Enough has been said to demonstrate the extremely faulty condition of tax methods in the United States. Uniformity is highly desirable, but equality of burden is even more to be desired. The advances in this direction have been few, and accomplished only partially in a few States. The machinery for making assessments is only a part of the problem, as the intention of the law, the spirit of the act, is of even higher importance in securing justice and moderation. If these essays, incomplete as they must of necessity be, have led to a better comprehension of the chaotic condition existing now and of the difficulties to be overcome, their object will have been attained. The remedy may be left for time to effect.

In connection with the celebration of the centenary of the death of the naturalist Lazaro Spallanzani, at Reggio, Italy, in February last, a booklet has been published containing articles on various aspects of the life and work of Spallanzani and matters associated with him. Among the authors represented are Mantegazza, Ferrari, and others well known in Italian science.

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substructures, and superstructures, erected upon, under, or above, or affixed to the same; all wharves and piers, including the value of the right to collect wharfage, cranage, or dockage thereon; all bridges, all telegraph lines, wires, poles, and appurtenances; all supports and inclosures for electrical conductors and other appurtenances upon, above, and underground; all surface, underground, or elevated railroads, including the value of all franchises, rights or permission to construct, maintain, or operate the same in, under, above, on, or through streets, highways, or public places; all railroad structures, substructures, and superstructures, tracks, and the iron thereon, branches, switches, and other fixtures permitted or authorized to be made, laid, or placed on, upon, above, or under any public or private road, street, or grounds; all mains, pipes, and tanks laid or placed in, upon, above, or under any public or private street or place for conducting steam, heat, water, oil, electricity, or any property, substance, or product capable of transportation or conveyance therein, or that is protected thereby, including the value of all franchises, rights, authority, or permission to construct, maintain, or operate in, under, above, upon, or through any streets, highways, or public places, any mains, pipes, tanks, conduits, or wires, with their appurtenances, for conducting water, steam, heat, light, power, gas, oil, or other substance, or electricity for telegraphic, telephonic, or other purposes; all trees and underwood growing upon land, and all mines, minerals, quarries, and fossils in and under the same, except mines belonging to the State. A franchise, right, authority, or permission, specified in this subdivision, shall for the purposes of taxation be known as a 'special franchise.' A special franchise shall be deemed to include the value of the tangible property of a person, copartnership, association, or corporation, situated in, upon, under, or above any street, highway, public place, or public waters, in connection with the special franchise. The tangible property so included shall be taxed as a part of the special franchise." The reason for classing franchises as real estate was that under the existing laws of New York a franchise could not be assessed as personal property, as the bonded debt could then be deducted, leaving little or nothing to be taxed.

BACON'S IDOLS: A COMMENTARY.

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IN the first book of the *Novum Organon* the great leader of the new philosophy undertook to set forth the dangers and difficulties which stand always in the way of clear and fruitful thought. Conscious that he was breaking entirely with the schools of the past, and ambitious of laying the firm foundations on which all future inquirers would have to build, it was natural that Bacon should pause on the threshold of his vast enterprise to take stock of the mental weaknesses which had rendered futile the labors of earlier thinkers, and which, if not carefully guarded against, would jeopardize the efforts of times to come. That the understanding may direct itself effectively to the search for truth it is necessary, he insisted, that it should have a full apprehension of the lapses to which it is ever liable, the obstacles with which it will constantly have to contend. A vague sense of peril is not enough. As a first condition of healthy intellectual activity we must learn to know our frailties for what they really are, estimate their consequences, and probe the secrets of their power.

Bacon's statement of the sources of error and vain philosophizing is regarded by him as merely the *pars destruens* or negative portion of his work—as it were, "the clearing of the threshing floor." But his aphorisms are packed close with solid and substantial thought, and well deserve the attention of all who would seriously devote themselves to the intellectual life. "True philosophy," as he conceived it, "is that which is the faithful echo of the voice of the world, which is written in some sort under the direction of things, which adds nothing of itself, which is only the rebound, the reflection of reality." To reach for ourselves, as nearly as we may, a philosophy which shall meet the terms of this exigent definition is, or should be, one chief purpose of our study and our thought. We may very well ask, then, what help so great and suggestive a thinker may give us on our way.

With his characteristic fondness for fanciful phraseology, Bacon describes the causes which distort our mental vision as *Idola*—idols or phantoms of the mind.* Of such he distinguishes four classes, which he calls, respectively: Idols of the Tribe (*Idola Tribus*); Idols of the Cave (*Idola Specus*); Idols of the Market Place (*Idola*

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* *Idola* (Greek εἴδωλα), though commonly rendered idols, would here undoubtedly be more correctly translated phantoms or specters. With this explanation, however, I shall usually employ the more familiar word.

Fori); and Idols of the Theater (*Idola Theatri*). It is not to be claimed for Bacon's analysis that it is exhaustive or always scientifically exact. In many places, too, it opens up difficult philosophic questions, which for the present must be disregarded. But, as Professor Fowler has said, there is something about his diction, "his quaintness of expression, and his power of illustration which lays hold of the mind and lodges itself in the memory in a way which we can hardly find paralleled in any other writer, except it be Shakespeare." * Moreover, though he often deals with matters of merely technical and temporary interest, his leading thoughts are of permanent and universal applicability. Let us see, then, what suggestions we can gather from a brief consideration of his Idols, one by one.

Idols of the Tribe are so called because they "have their foundation in human nature itself"; in other words, they are the prepossessions and proclivities which belong to men as men, and as such are common to the whole race or tribe. "Let men please themselves as they will," says Bacon, "in admiring and almost adoring the human mind, this is certain: that as an uneven mirror distorts the rays of objects according to its own figure and section, so the mind, when it receives impressions of objects through the sense, can not be trusted to report them truly, but in forming its notions mixes up its own nature with the nature of things." In many lines of thought there is no more pregnant source of fallacy and confusion than the tendency, innate in all and seldom properly checked, to accept man as the measure of all things, and to translate the entire universe into terms of our own lives. Theology, though it is slowly outgrowing its cruder anthropomorphism, still talks about the "will" of God, an "intelligent" First Cause, the "moral governor," and "lawgiver"; and outside theology we have ample evidence of the persistency with which we humanize and personify Nature by endowing it with attributes belonging to ourselves. Darwin confessed that he found it difficult to avoid this tendency.† It is a pitfall into which men constantly stumble in their attempts to interpret the processes at work about them.

One important result of our habit of thus forcing the universe to become "the bond-slave of human thought" is to be found, as Bacon notes, in our proneness to "suppose the existence of more order and regularity in the world" than is actually to be discovered there. While we read design and purpose into the phenomena of Nature because we are conscious of design and purpose in our own activities, thus allowing ourselves to drift into the metaphysical doctrine of Final Causes, we also do our best to bring Nature's mul-

* Novum Organon, edited by Thomas Fowler, introduction, p. 132.

† Animals and Plants under Domestication, vol. i, p. 6.

titudinous operations into such definite formulas as will satisfy our love of plan and symmetry. We are not content till we can systematize and digest, whence our continual recourse to loose analogies and fanciful resemblances. We start from an imagined necessity of order, or from some conception of things attractive because of its apparent simplicity, and then reason out from this into the facts of Nature. Mill furnishes some telling examples. "As late as the Copernican controversy it was urged, as an argument in favor of the true theory of the solar system, that it placed the fire, the noblest element, in the center of the universe. This was a remnant of the notion that the order of the universe must be perfect, and that perfection consisted in conformity to rules of procedure, either real or conventional. Again, reverting to numbers, certain numbers were *perfect*, therefore these numbers must obtain in the great phenomena of Nature. Six was a perfect number—that is, equal to the sum of all its factors—an additional reason why there must be exactly six planets. The Pythagoreans, on the other hand, attributed perfection to the number ten, but agreed in thinking that the perfect numbers must be somehow realized in the heavens; and knowing only of nine heavenly bodies to make up the enumeration, they asserted 'that there was an *antichthon*, or counter-earth, on the other side of the sun, invisible to us.' Even Huygens was persuaded that when the number of heavenly bodies had reached twelve it could not admit of any further increase. Creative power could not go beyond that sacred number." * Do these concrete illustrations of perverse reasoning strike us as ludicrous? It is because they are taken from an order of ideas long since outgrown. The tendencies they exemplify have not been outgrown. We have only to keep a vigilant eye on our own mental conduct to be convinced that we are very apt to begin with some general notion of "the fitness of things," or what "ought to be," and to argue thence to conclusions not a whit less absurd essentially than those just referred to.

While these universal mental habits are conspicuous enough in the higher regions of thought and begin to play tricks with us the moment we undertake on our own accounts any serious speculation, there are other Idols of the Tribe whose influence is perhaps more commonly fatal. We all jump at conclusions, the mind feigning and supposing "all other things to be somehow, though it can not see how, similar to those few things by which it is surrounded"; we all allow ourselves to be unduly "moved by those things most which strike and enter the mind simultaneously and suddenly, and so fill the imagination." Hasty judgments are thus daily and hourly passed on men and things, and rash generalizations permitted to

* Logic, ninth edition, Book V, chapter v, § 6.

circulate untested. Even more disastrous, perhaps, in the long run, is the power of prepossessions. When once, says Bacon, the human understanding has "adopted an opinion (either as being the received opinion, or as being agreeable to itself)" it straightway "draws all things else to support and agree with it." Illustrations may be found in every direction. Note, for instance, the vitality, even in the teeth of positive disproof, of many long-accepted and often-challenged ideas—belief in dreams, omens, prophecies, in providential visitations and interpositions, in the significance of coincidences, in popular saws about natural phenomena, in quacks and quackery, in old wives' tales, vulgar and pseudo-scientific. The story of witchcraft is only another example of the same kind, though written large in the chronicles of the world in letters of fire and blood; the human understanding had "adopted" a belief in witches, and drew "all things else to support and agree with it." In all such cases of prepossession the mind obstinately dwells on every detail that favors its accepted conclusions, while disregarding or depreciating everything that tells against them; it is always, in Bacon's phrase, "more moved and excited by affirmatives than by negatives." Thus, we hear much of the one dream that is fulfilled, and of the ninety and nine that are unfulfilled—nothing. Bacon illustrates this perversity by the well-known anecdote of the ancient cynic, which may be left to convey its own moral: "And therefore it was a good answer that was made by one who, when they showed him hanging in a temple a picture of those who had paid their vows as having escaped shipwreck, and would have him say whether he did not now acknowledge the power of the gods—'Ay,' asked he again, 'but where are they painted that were drowned after their vows?'"

Finally, among these Idols of the Tribe we must include the disturbance caused by the play of feeling upon the mind. "The human understanding is no dry light, but receives an infusion from the will and affections, whence proceed sciences which may be called 'sciences as one would.'" We all know, to our cost, how passion will warp judgment; how difficult it is to see clearly when the emotions are thoroughly aroused; how tenaciously men cling to opinions they are familiar with, or would fain have to be true; how fiercely they contest ideas that are unfamiliar or repugnant. Had it been contrary to the interest of authority, observed shrewd old Hobbes, that the three angles of a triangle should be equal to two angles of a square, the fact would have been, if not disputed, yet suppressed.* Similarly, if the passions of men had been called into play over the most clearly demonstrable of abstract mathematical

* Leviathan, Part I, chapter xi.

truths, we may be sure that furious controversy would have attended the issue, and some way found to overthrow the demonstration. That two and two make four would have been denied had any strong emotion been excited against the proposition. "Men," said Whateley, "are much more anxious to have truth on their side than to be on the side of truth." And the danger is greater because we are frequently not aware of the bias given by feeling. There are cases in plenty where men more or less consciously and deliberately espouse "sciences as one would," but there are many others in which the emotional interference is insidious and obscure. "Numberless, in short, are the ways, and sometimes imperceptible, in which the feelings color and infect the understanding."

These Idols of the Tribe are of course inherent in our intellectual constitution, and are ineradicable. The simple consideration that all knowledge is relative—that by no effort and under no circumstances can we escape beyond the conditions and limitations of our own minds—suffices to show that intelligence must ever mix up its own nature with the nature of things, though this fact need not make us doubt the validity of knowledge as is sometimes hastily inferred. For the rest, clear recognition of these common obstacles to thought should put us in the way of anticipating and withstanding their more serious effects. In practice it must be our object to maintain watchfulness and a careful skepticism; to test evidence and check passion; to cultivate candor, flexibility, and alertness of mind; to avoid loose generalizations; and to be ever ready to accept, revise, reject. Above all must we steadily resist the seductions of what is called common sense, and overcome that mental inertness which too often leads us to drift unthinking along the current of popular opinion.*

But, in addition to errors arising from the common intellectual nature of men, there are others, the sources of which are to be found in the idiosyncrasies of the individual mind. These Bacon calls Idols of the Cave; † for every one, he says, "has a cave or den of his own, which refracts and discolors the light of Nature, owing either to his own proper and peculiar nature; or to his education and conversation with others; or to his reading of books, and the authority of those whom he esteems and admires; or to the differences of impressions, accordingly as they take place in a mind preoccupied and predisposed, or in a mind indifferent and settled; and the like." This summary is comprehensive enough to indicate the character and point to some of the causes of individual aberrations of judg-

* It is well to remember that if common sense had said the last word about the matter, the Ptolemaic theory of the universe would still stand unshaken.

† The metaphor is taken from the opening of the seventh book of Plato's Republic.

ment; that it does no more than this is due to the simple fact that the personal bias is as varied as humanity itself, and that the deflecting impulses in any given case are to be referred to a complex of factors almost eluding analysis. To follow this part of the subject into detail would, therefore, manifestly be impossible. But certain of the larger and more widely influential of these disturbing forces may be roughly marked out by way of illustration.

In the first place, there is what we may call the professional bias. Exclusive devotion to separate lines of activity, study, or thought inevitably gives the mind a particular set or twist. Bacon complains that Aristotle, primarily a logician, made his natural philosophy the slave of his logic. Few specialists can escape the insulation consequent upon living too continuously in a confined area of problems and ideas. Their intellectual outlook is necessarily circumscribed, facts are seen by them out of proper perspective, and one-sidedness of training and discipline renders their judgment of things partial and incomplete. The lawyer carries his legal, the theologian his theological, the scientist his scientific bent of mind into every inquiry; with what grotesque results is only too frequently apparent. Accustomed to move in a single narrow groove, and wholly absorbed in the contemplation of certain isolated classes of phenomena, they unconsciously allow their particular interests to dominate their thought, and impose disastrous restrictions upon their view of whatever lies outside their own chosen field.

Secondly, we have the bias of nation, rank, party, sect. Here the mental disturbances are too numerous to permit and too obvious to require special exemplification. Intellectual provincialism of any kind is fatal to large and fertile thought, alike by limiting the range of our knowledge and sympathies and by inducing mental habits and implanting prejudices which prevent us from seeing things in wide relations and under a clear light. So long as our point of view is simply that of our country, our class, our party, or our church, so long, it is evident, our minds will lack the breadth and flexibility necessary for free inquiry, fruitful comparisons, sane and balanced judgments.*

Finally, among the Idols of the Cave "which have most effect in disturbing the clearness of the understanding," mention must be made of the temperamental bias. Every man, it has been said, is born Platonist or Aristotelian; it is certain that the great divisions in thought—religious, philosophical, political—answer roughly to fundamental differences in human nature, and that every one not checked or turned aside by extraneous influences will spontaneously gravitate in one or another direction. Bacon is only re-

* *Cf.* Spencer's Introduction to the Study of Sociology, chapters viii–xii.

cording a fact of the commonest experience when he says that "there are found some minds given to an extreme admiration of antiquity, others to an extreme love and appetite for novelty, but few so duly tempered that they can hold the mean, neither carping at what has been well laid down by the ancients nor despising what is well introduced by the moderns." Many instinctively brace themselves against authority and tradition; by others again, whatever is handed down to us by authority and tradition is for this reason alone treated with contempt. That the crowd believes a thing is enough to convince this man of its truth, and that of its falsehood.

"The vulgar thus through imitation err;
As oft the learned by being singular."

These and similar congenital differences in men's intellectual constitutions might be illustrated indefinitely if it were necessary. A further remark of Bacon's must, however, be quoted, for it goes deeper in mental analysis and touches a less obvious point. "There is one principal and, as it were, radical distinction between different minds in respect of philosophy and the sciences, which is this: that some minds are stronger and apter to mark the differences of things, others to mark their resemblances. The steady and acute mind can fix its contemplations and dwell and fasten on the subtlest distinctions; the lofty and discursive mind recognizes and puts together the finest and most general resemblances." Men belonging to the former class we should call logical and critical; those belonging to the latter, imaginative and constructive. Each class tends to the excesses of its own predominant powers, and in each case excess interferes with calm reasoning and sound judgment.

To correct the personal equation it is imperative that we should study ourselves conscientiously, consider dispassionately the natural tendencies of our birth, early surroundings, education, associations, and interests, and do our utmost to conquer, or at least to make allowance for, every individual peculiarity, temperamental or acquired, likely to turn the mind aside from the straight line of thought. Such self-discipline every one must strenuously undertake on his own account if he would wish to see things as they really are. Stated in more general terms, our aim must be to rise above all kinds of provincialism and personal prejudice, and to overcome our natural proneness to rest content in our own particular point of view. Bacon quotes with approval the words of Heraclitus: "Men look for sciences in their own lesser worlds, and not in the greater or common world." We must strive to escape from our own lesser world, and to make ourselves citizens of the greater, common world. For this we need the widest and most generous culture—the culture that is to be found in books, in travel, in intercourse with men of all classes and every shade of opinion. Left to ourselves we only too sedulously cultivate our own insularity; we mingle simply with the people who agree with us, belong to our own caste, and share our own prejudices; we read only the papers of our own party, the literature of our own sect; we allow our own special interests in life to absorb our energies, color all our thoughts, and narrow our horizon. In this way the Phantoms of the Cave secure daily and yearly more despotic sway over our minds. Self-detachment, disinterestedness, the power of provisional sympathy with alien modes of thought and feeling, must be our ideal. "Let every student of Nature," says Bacon, "take this as a rule, that whatever his mind seizes and dwells on with particular satisfaction is to be held in suspicion, and that so much the more care is to be taken in dealing with such questions to keep the understanding even and clear." A hard saying, truly, yet one that must be laid well to heart.

While the Idols of the Tribe, then, are common human frailties in thought, and the Idols of the Cave the perturbations resulting from individual idiosyncrasies, there are other Idols "formed by the intercourse and association of men with each other," which Bacon calls "Idols of the Market Place, on account of the commerce and consort of men there." By reason of its manifold and necessary imperfections—its looseness, variability, ambiguity, and inadequacy—the language we are forced to employ for the embodiment and interchange of ideas plays ceaseless havoc with our thought, not only introducing confusion and misconception into discussion, but often, "like the arrows from a Tartar bow," reacting seriously upon our minds. A large part of the vocabulary to which we must perforce have recourse, even when dealing with the most abstruse and delicate subjects, is made up of words taken over from vulgar usage and pressed into higher service; they carry with them long trains of vague connotations and suggestions; the superstitions of the past are often imbedded in them; no one can ever be absolutely certain of their intellectual values. While, therefore, they may do well enough for the rough needs of daily life, they prove sadly defective when required for careful and exact reasoning. And even with that small and comparatively insignificant portion of our language which is not inherited from popular use, but fabricated by philosophers themselves, the case is not much better. Every word, no matter how cautiously employed, inevitably takes something of the tone and color of the particular mind through which it passes, and when put into circulation fluctuates in significance, meaning now a little more and now a little less.* What wonder, then, that "the high and formal discussions of learned men" have so often begun and ended in pure logomachy, and that in discussions which are neither high nor formal and in which the disputants talk hotly and carelessly the random bandying of words is so apt to terminate in nothing beyond the darkening of counsel and the confusion of thought?

Bacon notes two ways particularly in which words impose on the understanding—they are employed sometimes "for fantastic suppositions . . . to which nothing in reality corresponds," and sometimes for actual entities, which, however, they do not sharply, correctly, and completely describe. The eighteenth century speculated at length on a state of Nature and the social contract, unaware that it was deluding itself with unrealities, and we have not yet done with such abstractions as the Rights of Man, Nature (personified), Laws of Nature (conceived as analogous to human laws), and the Vital Principle. The more common and serious danger of language, however, lies in the employment of words not clearly or firmly grasped by the speaker or writer—words which, in all probability, he has often heard and used, and which he therefore imagines to represent ideas to him, but which, closely analyzed, will be found to cover paucity of knowledge or ambiguity of thought. Cause, effect, matter, mind, force, essence, creation, occur at once as examples. Few among those who so glibly rattle them off the tongue have ever taken the trouble to inquire what they actually mean to them, or whether, indeed, they can translate them into thought at all.

Among the Idols of the Market Place we must also class the evils arising from the tendency of words to acquire, through usage and association, a reach and emotional value not inherent in their original meanings. This is what Oliver Wendell Holmes happily described as the process of polarization. "When a given symbol which represents a thought," said the Professor at the Breakfast Table, "has lain for a certain length of time in the mind it undergoes a change like that which rest in a certain position gives to iron. It becomes magnetic in its relations—it is traversed by

* The need of a language of rigid mathematical precision for the purposes of philosophic thought and discussion has long been the subject of remark. Hence Bishop Wilkins's Essay toward a real character and a philosophic language (1668), and the earlier Ars Signorum of George Dalgarno—boldly presented by its inventor as a "remedy for the confusion of tongues, as far as this evil is reparable by art." We may give these ingenious authors full credit for the excellent intentions with which they set out on impossible undertakings. A philosophic language may perhaps be attained in the millennium, but then probably it will be no longer needed. Meanwhile readers interested in the history of the mad scheme called Volapük may find some curious matter in these rare works.

strange forces which did not belong to it. The word, and consequently the idea it represents, is *polarized.*" The larger part of our religious and no small portion of our political vocabulary consist of such polarized words—words which, on account of their acquired magnetism, unduly attract and influence the mind. We can never hope to think calmly and clearly while the very symbols of our thoughts thus possess a kind of thaumaturgic power over us, which in turn readily transfers itself to our ideas.

If, then, "words plainly force and overrule the understanding and throw all into confusion and lead men away into numberless empty controversies and idle fancies," it behooves us to watch closely the interrelations of language and thought. To put it in the vernacular, we must at all times make sure that we know what we are talking about and say what we mean. To this end the study of language itself is useful, but the habits of precise thought and expression will never be acquired by linguistic exercise alone. To use no word without a distinct idea of what it means to us as we speak or write it; to check, when necessary, the process of thought by constant redefinition of terms; to depolarize all language that has become, or threatens to become, magnetic, thus translating familiar ideas into "new, clean, unmagnetic" phraseology, these may be set down as first among the rules to which we should tolerate no exception.

We now come to the last group of Idols—those "which have immigrated into men's minds from the various dogmas of philosophies, and also from wrong laws of demonstration." These Bacon calls Idols of the Theater, "because in my judgment all the received systems are but so many stage-plays, representing worlds of their own creation after an unreal and scenic fashion." And perhaps this conceit carries further than Bacon himself intended, for it not only suggests the unsubstantial character of philosophic speculations, but also reminds us how, in the world's history, these airy fabrics have succeeded each other as on a stage, some to be hissed and some applauded, but all sooner or later to drop out of popular favor and be forgotten.

Dealing with these Idols of the Theater, or of Systems (of which there are many, "and perhaps will be yet many more"), Bacon takes the opportunity of criticising, briefly but incisively, the methods and results of ancient and mediæval philosophers. His classification of false systems is threefold: The sophistical, in which words and the finespun subtilties of logic are substituted for "the inner truth of things"; the empirical, in which elaborate dogmas are built up out of a few hasty observations and ill-conducted experiments; and the superstitious, in which philosophy is corrupted by myth and tradition. Under the first head, Bacon again instances Aristotle, whom he accuses of "fashioning the world out of categories"; under the second he glances especially at the alchemists; and under the third he refers to Pythagoras and Plato. To follow Bacon into these historic issues does not belong to our present purpose. Suffice it to notice the continued vitality of these three classes of speculative error. Bacon's judgment of Aristotle—that "he did not consult experience as he should have done, in order to the framing of his decisions and axioms; but, having first determined the question according to his will, he then resorts to experience, and, bending her into conformity with his placets, leads her about like a captive in a procession"—is at least equally applicable to thinkers like Hegel and his followers. Empiricism has by no means been eliminated from the scientific or would-be scientific world. And as for the philosophy which is corrupted by myth and tradition, the countless attempts that are still made to "reconcile" the facts of science with the data and prepossessions of theology are enough to prove that, *mutato nomine*, the methods of Pythagoras and Plato and of those who in Bacon's day sought "to found a system of natural philosophy on the first chapter of Genesis, on the book of Job, and other parts of the sacred writings," are as yet far from obsolete.

It is hardly necessary to call attention to the fact that there is a close similarity between systematic empiricism and some of the dangers brought out in connection with the Idols of the Tribe, for in each case stress must be laid on the tendency to generalize hastily, depend on scattered and inadequate data, and seek for light in the "narrowness and darkness" of insufficient knowledge. This matter is important only as showing how a common weakness may be caught up and dignified in a philosophic system and rendered more dangerous by the adventitious weight and influence which it gains thereby. Another point, not distinctly dealt with by Bacon, calls, however, for special remark. While the various Idols of the Theater, or of Systems, exercise their own peculiar and characteristic influences for evil, they all tend to the debasement of thought by reason of the authority which they gradually acquire. Associated with great names, promulgated by schools, officially expounded by disciples and commentators, they finally settle into a creed which is regarded as having oracular and dogmatic supremacy. The formula "Thus saith the Master" closes discussion. Not the fact itself, but what this or that teacher has said about the fact, comes at last to be the all-important question. In the condition of mind thus engendered there is no chance for intellectual freedom, self-reliance, growth. Lewes related an anecdote of a mediæval student "who, having detected spots in the sun, communicated his discovery to a worthy priest. 'My son,' replied the priest, 'I have read Aristotle many times, and I assure you that there is nothing of the kind mentioned by him. Go rest in peace, and be certain that the spots which you have seen are in your eyes, and not in the sun.'" * Such an incident forms an admirable commentary on the saying of the witty Fontenelle that Aristotle had never made a true philosopher, but he had spoiled a great many. The position assumed is simple enough: Aristotle *must* be right, therefore whatever does not agree with the doctrines of the Stagirite must be wrong. Are your facts against him, then revise your facts. Come what may of it, you must quadrate knowledge with accepted system. Here is the theological method in a nutshell. And the theological method has only too often been the method also of the established philosophic schools.

In our own relations with these Idols of the Theater the first and last thing to remember is that all systems are necessarily partial and provisional. "They have their day and cease to be," and at the best they only mark a gradual progress toward the truth. There can be no finality, no closing word authoritatively uttered. Our attitude toward the systems of the past and the present, toward long-accepted traditions, and dogmatically enunciated conclusions, must be an attitude of firm and steady—of respectful, it may be, but still firm and steady—independence. We must resist the tendency to passive acquiescence, and endeavor to combine with generous hospitality to all ideas the habit of not accepting anything merely because it is stated *ex cathedra*, or is backed by an influential name, or can "plead a course of long observance for its use." Perhaps to wean ourselves from this particular form of idolatry there is nothing so helpful as a wide and constant study of the history of thought. The pathway of intellectual development is strewn with outgrown dogmas and exploded systems. How fatuous, then, to accept, whole and untested, the doctrine of any master, new or old, believing that his word will give us complete and undiluted truth!

So much, then, we may say with Bacon "concerning the several classes of Idols and their equipage, all of which must be renounced and put away with a fixed and solemn determination, and the understanding thoroughly freed and cleansed; the entrance into the kingdom of man, founded on the sciences, being not much other than the kingdom of heaven, whereinto none may enter except as a little child." It may perhaps be urged that the result of such a survey as we have taken of the obstacles to clear thought is

* History of Philosophy, vol. ii, pp. 95, 96.

to leave the mind dazed and discouraged, partly because the suggestions made for the conquest of these obstacles, though easily formulated in theory are difficult and sometimes impossible in practice, and partly because the general if not expressed tendency of our analysis is (it may be said) in the direction of that Pyrrhonic skepticism which "doomed men to perpetual darkness." To the former objection I have only to reply that it is one to which all discussions of the principles and problems of conduct are necessarily open. "If to do were as easy as to know what were good to do, chapels had been churches, and poor men's cottages princes' palaces." * None the less, to state as lucidly as we can what were good to do under certain circumstances is properly regarded as part of the business of ethics. The other point is touched upon by Bacon himself in words which it would be impertinent to seek to better: "It will also be thought that by forbidding men to pronounce and set down principles as established until they have duly arrived through the intermediate steps at the highest generalities, I maintain a sort of suspension of the judgment, and bring it to what the Greeks call *acatalepsia*—a denial of the capacity of the mind to comprehend truth. But in reality that which I meditate and propound is not *acatalepsia*, but *eucatalepsia;* not denial of the capacity to understand, but provision for understanding truly; for I do not take away authority from the senses, but supply them with helps; I do not slight the understanding, but govern it. And better surely it is that we should know all that we need to know, and yet think our knowledge imperfect, than that we should think our knowledge perfect, and yet not know anything we need to know."

MATHEMATICS FOR CHILDREN.

By M. LAISANT.

EXCEPT with persons having specially favorable surroundings, I believe that the vast majority of parents have a feeling of dread at the thought of putting their children to the study of mathematics. They know that the child must learn something about it in order to pass his examinations; but with this knowledge goes an apprehension of loading his mind with those ideas which are so complicated and hard to acquire, and we put off the dreaded moment of setting him to work as late as possible.

While I believe it is wise to spare the child all useless overwork, I am persuaded also that the best way of sparing him is not to

* This quotation is *not* from Bacon.

shrink from initiating him into hard work, if that can be done in a rational way.

I regard all the sciences as, at least to a certain extent, experimental, and, notwithstanding the views of those who would regard the mathematical sciences as a series of operations in pure logic, resting upon strictly ideal conceptions, I believe that we may affirm that there does not exist a mathematical idea that can enter our brain without the previous contemplation of the outer world and the facts it offers to our observation. This affirmation, the discussion of which now would carry us too far, may help to a clear idea of the way we should try to convey the first mathematical ideas to the mind of the child.

The outer world is the first thing the child should be taught to regard and concerning which he should be given as much information as possible—information which he will have no trouble in storing, we may well believe, and from this outer world the first mathematical notions should be borrowed; to these should succeed later an abstraction, which is less complicated than it seems.

Our primary teaching of arithmetic now follows in the tracks of that of grammar, as we might as well say that the teaching of grammar follows in the tracks of that of arithmetic. That is, in either case we teach the child a number of abstract and confusing definitions which he can not comprehend, imposing on him a series of rules to follow under the pretext of giving him a good practical direction, and we force him to learn and memorize these rules whether they are good for anything or not.

When the child has grown older he is given two or three short lessons a week in science, nine tenths of which, with his fleeting memory, he forgets before the next week's lessons come on. He can not relish anything that is taught him in that way, and it would be vastly better to give him no scientific ideas at all than to scatter them around in such a way, for all teachers agree that a fresh pupil is more easily dealt with and can be taught more satisfactorily and thoroughly than one who has been mistaught.

When the student has passed through it all and has established himself in life he is apt to look back upon his experiences under such teachings in no very amiable mood, and to regard such matters in the light of barriers that were set up to prevent his getting his diploma with too little work; and even if his profession is one that calls for applications of mathematics he prepares himself with sets of formulas that enable him to dispense with the imperfect instruction he has received.

When we think of giving a child a mathematical education we are apt to ask whether he has special aptitudes fitting him to receive it. Do we ask any such questions when we talk of teaching him to read and write? Oh, no! we all acknowledge that reading and writing are useful, practical, and indispensable arts, which every human being not infirm or defective should learn. Now, elementary mathematics, which represents a tolerably extended equipment, is no less useful and indispensable than the knowledge of reading and writing, and I assert further, what may seem paradoxical to many, that it can be assimilated with much less fatigue than the earliest knowledge of reading and writing, provided always that instead of proceeding in the usual way and giving lessons bristling with formulas and rules, appealing to the memory, imposing fatigue, and producing nothing but disgust, we adopt the philosophical method of conveying ideas to the child by means of objects within reach of his senses. The teaching should be wholly concrete and applied only to the contemplation of external objects and their interpretation, and the instruction should be given continually, especially during the primary period, under the form of play. Nothing is easier than this, then, in arithmetic; for instance, to use dice, beans, balls, sticks, etc., and by their aid give the child ideas of numbers.

Do we do anything of this kind? When I was taught to read and write I knew how to write the figure 2 before I had any idea of the number two. Nothing is more radically contrary to the normal working of the brain than this. The notion of numbers —up to 10, for example—should be given to the child before accustoming him to trace a single character. That is the only way of impressing the idea of number independently of the symbol or the formula which is only too ready to take the place in the mind of the object represented by it.

When a child has learned to count through the use of such objects as I have mentioned he may be taught what is called the addition table. This table can be learned by heart easily enough, but when we reach the multiplication table we come upon one of the tortures of childhood. Would it not be simpler and easier to make the children construct these tables, instead of making them learn them?

Let us first take the addition table, and suppose that we trace ten columns on suitably ruled paper, at the top of which we write the first ten numbers, for example, and then write them again at the beginning of a certain number of horizontal lines (Fig. 1). Let us suppose, too, that we have a box divided into compartments arranged like the squares in our table, into which we put heaps of balls, beans, or dice corresponding to the numbers indicated in the table. The child will take, for example, two balls from one compartment and three from another, will put them together and place his five balls in the case corresponding with the point where the lines of two and three will meet, and will thus gradually accustom himself to the idea that two added to three are equal to five, four and two to six, etc.,

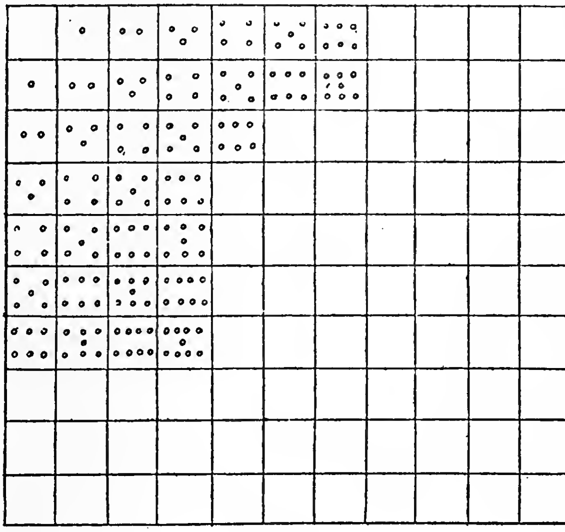


FIG. 1.

before he knows how to write the corresponding figures. As soon as he has learned how to write them he can himself make the table with figures (Fig. 2), showing that one and one make two, one and three four, etc.

This will be all the easier for him because he will only have to write the figures in their order in the lines and the columns. This furnishes an excellent writing exercise after the children have begun to write figures, and affords besides a certain method of teaching them the addition table up to nineteen at least. I insist that all this can be done even before the child knows how to write the figures by means of an arrangement like a printer's case, and that it will be as a play, rather than a study, to the child. Hardly anything more will be required than to bring the toy to the child's notice and leave him to himself after he has been started with it, and he will get along the faster the less he is bothered.

A similar process may be adopted with the multiplication table. With a case like the other, it is only necessary to tell the child that if he wants to know how much are three times four he has only to make heaps of four things each, take three of them and put them in the box at the intersection of the line three and the column four. If he can write the figures he will write 12, instead of gathering up the twelve objects that represent the product. When he has played at this for some time he may become acquainted with all the products up to ten times ten or beyond without having to make any abnormal effort of memory.

The idea of numeration, which is usually put off till a later period, should also be given at the beginning. Children soon under-

	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
2	3	4	5	6	7	8	9	10	11	12
3	4	5	6	7	8	9	10			
4	5	6	7	8	9	10				
5	6	7	8	9	10					
6	7	8	9	10						
7	8	9	10							
8	9	10								
9	10									

Fig. 2.

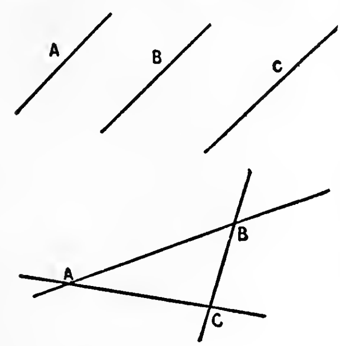
stand the decimal numeration and learn to write 10 for ten, and other numbers composed of one of the nine ciphers and zero. But the fact which, however, though quite essential to know, receives very little attention is that there is nothing particular about this number ten, and that systems of numeration can be devised resting on any basis that may be taken; that the principle of every system of numeration consists in taking a certain number of units and grouping them. Take, for example, a system having five as its basis. All the numbers of such a system can be represented with the figures 1, 2, 3, and 4, the symbol 10 standing in this case for five. To construct a number we have only to group the units by fives and observe the result.

To learn decimal numeration by this process we put tens of objects into little boxes, tens of little boxes into larger ones, and so on. The child can in this way acquire an exact idea of the units of successive order in any system that may be desired.

This method of teaching was developed in a remarkable way about thirty years ago by Jean Macé in a little book entitled *L'Arithmétique du Grand-Papa*—Grandpa's Arithmetic—which made some impression when it appeared, but has been substantially forgotten.

In this method I attach much importance to giving these exercises a form of play. I believe that nothing in primary instruction should savor of obligation and fatigue. It would, on the other hand, be better to try to induce the child to desire himself to go on, and it would always be well to try to give him the illusion, in all stages of instruction, that he is the discoverer of the facts we wish to impress upon his mind.

We need not stop with arithmetic, but may go on and give the child a little geometry. To accomplish this we should give him the idea of geometrical objects, and to some extent their nomenclature, and this can be done without causing fatigue. To accomplish this he should be taught to draw, however rudely. He can begin with straight lines, of which he soon learns the properties; then, when he has drawn several lines side by side, he will learn that they are parallels and will never meet. He will learn, too, after he has drawn three intersecting lines, that the figure within them is called a triangle, that the figure formed by two parallel lines meeting two other parallels is a parallelogram, and he can go on to make and learn about polygons, etc (Fig. 3). All this nomenclature will get into his head without giving abstract definitions, but in such a way that when he sees a geometrical object of definite form he will recognize it at once and give it the name that belongs to it.



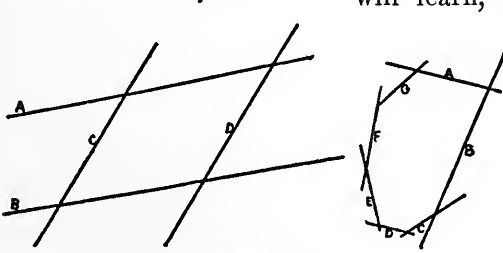


FIG. 3.

In the practical matter of the measurement of areas we convey immediate comprehension as to many figures without special effort, provided we do not present the demonstration in professional style, limiting ourselves to making the pupil comprehend or feel things so clearly and definitely that it shall be equivalent, as to the satisfaction of his mind, to an absolutely rigorous demonstration. At any rate, he will be better provided for the future than by rigorous demonstrations that he does not understand. Taking the parallelogram, for example, let us suppose a figure made like Fig. 4, and we saw through it along the lines *A A′* and *B C*. It does not need a very great effort of attention to recognize, experimentally if need be, that the two triangles *A A′ D* and *B B′ C* may be placed one upon the other and are identical. If, from the figure thus formed, we take away the right-hand triangle the parallelogram will remain; if we take away the other triangle a rectangle will be left, or a peculiar parallelogram, of which also we give the idea to the child as a figure in which the angles are formed by straight lines perpendicular to one another. Here, then, the child gains the notion of the equivalence of a parallelogram and a rectangle of the same base and height; and this notion, obtained by cutting up a piece of board or pasteboard, he will carry so seriously and firmly in his head that he will never lose it. By cutting the same parallelogram in two, along a diagonal *A C*, it may be easily shown that the two triangles can be placed exactly one upon the other, and that, consequently, they have equal areas. These lessons constitute a series of classical theorems in geometry which the child can try with his fingers and learn without even giving them the form of theorems. I might show the same as to the area of the trapeze and with many other theorems, but my purpose is only to present as many examples as will make my idea understood, without going into details.

Yet I can not leave this subject without showing how we can make a very child understand some of the geometrical theorems that have acquired a bad reputation in the world of candidates for degrees, including even such as the *pons asinorum* of Pythagoras; the demonstration, that is, that if we construct the triangles *B* and *C* on the sides of a right-angled triangle, their sum will be equal to the square *A* constructed on the hypotenuse. The usual demonstration of this theorem is not very complicated, but there is something tiresome, artificial, and hard in it. The demonstration I propose is almost intuitive, and the reasoning of it is both simple and rigorous.

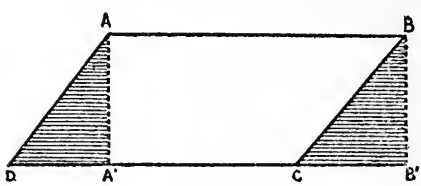


Fig. 4.

Suppose we take two equal squares, and, making equal lengths on the four sides of one of them, join the points so obtained as indicated in the first of the two figures (Figs. 5 and 6) so as to form four right-angled triangles, and then place four other squares in the corners of the original square. These right-angled triangles are of such sort that the sum of their sides is equal to the side of the square.

This can be demonstrated, but it strikes the eyes without that. We see, too, that the interior figure is a square, and that it is constructed on the hypotenuse of the triangles in question.

It is easy to see in the other figure, which is formed after the same measures as its alternate, that the triangles 1, 2, 3, 4 can be

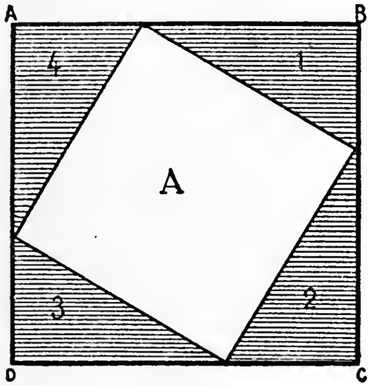


Fig. 5.

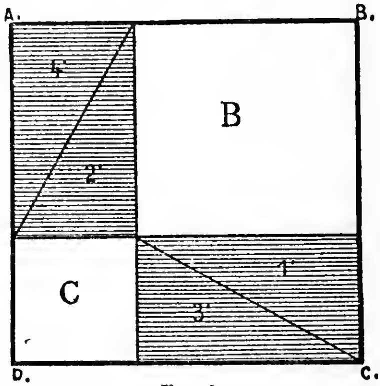


Fig. 6.

arranged so as to occupy the positions 1′, 2′, 3′, 4′ in such way as to leave in the main square two smaller squares constructed on the sides of one of the right-angled triangles. It follows that the square A is equivalent to the sum of the squares B and C. The theorem thus becomes a kind of intuition, a thing evidently indisputable.

It is a curious fact that the origin of this demonstration is lost in the obscurity of the past; it probably goes back to thirty or forty centuries, at least, before the Christian era, and apparently to India. Bhascara, in his *Bija Ganita*, after tracing a figure, a simple combination of these two, says, "There you see it." I remark that such a demonstration, even if dressed with geometrical terms, assuming a character that conforms to existing ways of teaching, would be vastly superior, even in secondary schools, to the demonstrations of Legendre and others, which are much harder. The return to what was done very long ago in this case constitutes a great advance upon what we are doing now.

Having given our little one an initiation into the mysteries of arithmetic and geometry, we introduce him to algebra, a branch which passes in the majority of families as the hardest, most complicated, and most abstruse that can be imagined. I do not pretend that algebraic theories enter easily into the child's delicate brain; rather the contrary; but I declare that some ideas in algebra can be made comprehensible to children without fatigue. We can, for instance, make them understand, in the way of amusement and without great difficulty, the formula that gives the sum of the first numbers. We take a sheet of paper ruled in squares and shade the first square of the first line, then the first two squares of the second line, the first three of the third, etc. (Fig. 7). The whole number of squares shaded in this manner represents visibly the sum of the first whole numbers up to any one we may choose—to 7 in the figure. If we give this paper to the child and ask him to return it, he will

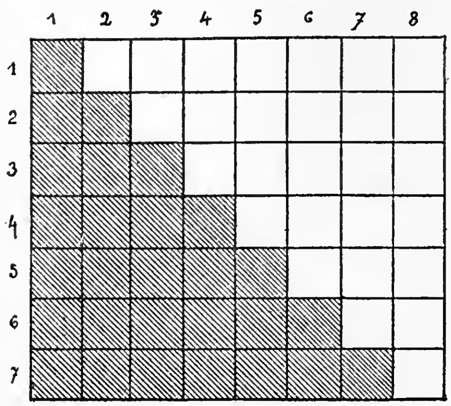


Fig. 7.

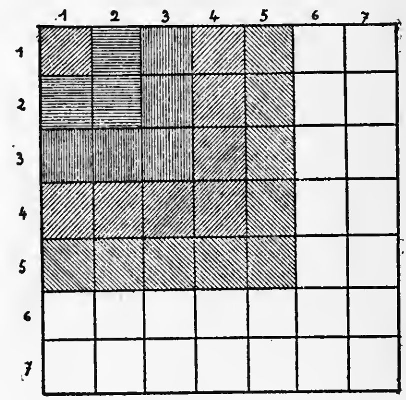


Fig. 8.

very easily perceive that the figures formed by the white and the black squares are alike. The number sought for will therefore be equal to half the sum of the squares—that is, in the present example

$$1 + 2 + 3 + 4 + 5 + 6 + 7 = (7 \times 8) : 2 = 28,$$

we can prove by reasoning that if n be taken to represent the last number we shall have for the sum

$$S = \frac{n\,(n+1)}{2}$$

I introduce this formula to define my thought better, but one can make the child perceive the numbers that are wanted without writing down a single character.

Somewhat similar is the method of finding the sum of the odd numbers. For this it will be enough to take our square-ruled sheet of paper and shade the first square on the left, then the three squares around it, which will form with it a square $(1 + 3 = 4)$; continuing thus we obtain, as the figure readily shows (Fig. 8), a square formed of a series of shaded zones, representing the series of odd numbers, the examination of which will illustrate the property to the child.

In another direction it is possible to give the child algebraic ideas much beyond anything we would imagine. Suppose, for example, we want to give him a conception of addition. He easily realizes that objects—material bars, for example—can be selected so as to represent numbers by their length. He can be readily made to understand that if he has one bar three and another five inches long he can obtain the sum of these lengths, in what we might call a material way, by placing them lengthwise, one at the end of the other—an essentially practical notion and easily carried into effect. If we take a line and mark a starting point on it, calling it zero, then measure off segments on it representing the bars we have been talking about one after another, we can get the sum represented by the length of the two segments. If, instead of measuring three plus five inches I measure three plus two I reach another point. If, instead of adding two and three, I wish to take one of the bars or numbers away $(3-2)$, or subtract, the operation will be easily performed by measuring the two in the opposite direction. The difference will be represented by the length that is left. If we try to form the quantity $3-5$ in arithmetic we can not do it; but in proceeding in this method and measuring back on the bar we get to a point back of the original starting point which represents this difference—say two inches behind where we began. Here we have in the germ the whole theory of negative quantities, concerning which thousands and thousands of pages have been written. Yet we find that by carefully graduating our lines we can make it intuitive and accessible to a child who has learned that the common operations of addition and subtraction can be represented with material objects. The generation of negative and positive quantities follows quite naturally.

These examples, I think, are sufficient to show that we might considerably enlarge the field of the investigations within reach of the child. For this purpose a small amount of very simple material, which we can vary as we please, is needful. The first element of this material is paper ruled in squares, a wonderful instrument, which everybody dealing with mathematics or with science generally should have. It is of special pedagogic use in giving children their first ideas of form, size, and position, without which their early instruction is only a delusion. Add to this paper dice, buttons, beans, and match-sticks—things always easy to get—and we have all the material we need.

There is no amusement, however puerile it may appear, not even a play of words, that can not be utilized in teaching of this sort. For instance, when your child has learned his addition table, if you put him to a demonstration, assuming to prove to his comrades that six and three make eight, his curiosity will be excited, and you may be very sure that, once his attention has been given to this amusement, he will never forget that six and three make nine and not eight. To make the demonstration, we have only to group the nine match-sticks as in the figure (Fig. 9) below. We might demonstrate in a like way that half of twelve is seven by cutting the Roman numeral XII in two, leaving the upper part visible. Such pleasantries have a pedagogical value, because the paradox is precisely of a kind to attract the attention of the child, and he will always afterward be sure not to fall into the trap.

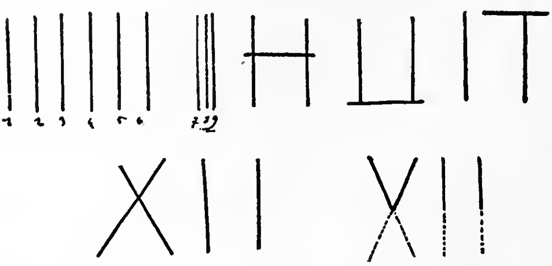


Fig. 9.

The side of this kind of instruction on which I insist most is that, given under the form of play, it is free from every sort of dogmatic character. No truth should be imposed on the child; on the contrary, he should be allowed to discover it as a fruit of his own activity. He will be thoroughly impressed with the truths which he has thus found out himself. They had better be few at first; the important thing is for him to know them completely.

The instruction should also be essentially objective and free from all abstraction. The absence of abstraction should, however, be rather apparent than real. Abstraction is indeed one of the elements that contribute most to give mathematical science a fearful air to outsiders, and yet it is most usually a simplification of matters—quite the contrary of what is generally supposed. It is, in fact, such a simplification and so necessary that we all make it as if by instinct, and the child makes it, not in mathematics only, but in all the considerations of life.

Thus, when I want to give the child his first idea of the number two I put two beans in his hand and let him contemplate them. He gets a perfect notion of the collection two. Yet, if you look at them a little closer and he himself looks at them closer he will find that the two beans, whatever else they may be, are not identical, for there exist no two objects in Nature that are not different. So when the child introduces this idea of collection into his mind in a wholly instinctive way, by identifying the things he sees, he begins to perform abstraction. This abstraction delivers him from all the complications and all the annoyances that come to him from the contemplation of real objects. By the philosophic process of abstraction it has been possible to construct all the sciences, and especially the science of magnitudes.

The ideas I have been setting forth in outline are not mine, and are, unfortunately, not recent. They may be found in somewhat different form, but substantially the same in principle, in *l'Essai d'education nationale,* published by Le Chalotais in 1763. The paper furnishes a programme of studies and education which, if put into execution, would, I believe, constitute a long advance over the present conditions. At a later period Condorcet was occupied with the subject. At the close of the nineteenth century the name of Jean Macé, which I have already cited, should be held among those of men who have tried to infuse sound and just views concerning the pedagogy of mathematics. Another man, from whom I have borrowed a considerable part of the examples I have cited, is Edouard Lucas, who, in his *Récréations mathématiques*, of which one volume was published during his lifetime and two others after his death, and in his lectures before the Conservatoire des Arts et Métiers, strove to develop views concerning the primary mathematical education of childhood—views which did not differ, except in form, from those which I have presented.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

PRESENT POSITION OF SOCIOLOGY.

By F. SPENCER BALDWIN.

THE present condition of sociological thought is confused, if not chaotic. It needs only a brief examination of the writings of professed sociologists to discover the want of agreement among them. There is no consensus of opinion regarding either the scope and method of the new science, so called, or its fundamental laws and principles. The name sociology stands for no definite body of systematic knowledge. It is applied to an inchoate mass of speculation, often vague and conflicting, which represents the thought of various thinkers about social phenomena.

A few years ago a student of sociology in Chicago wrote to "all the teachers of sociology in the United States, and to others known to be deeply interested in the subject and entitled to express an opinion," asking them to answer a number of pertinent questions regarding the nature and function of the "science." * About forty replied; of these, three discreetly pleaded knowledge insufficient to entitle them to an opinion. Comparison of the views expressed in the remaining twenty-seven replies led the investigator to conclude that the science is in a more or less undefined and tentative position.

* Present Condition of Sociology in the United States. Ira W. Howarth. Annals of the American Academy, September, 1894.

So little progress toward unanimity of opinion has been made by sociologists since the date of this census that its results may be taken as typical of present conditions. Among the questions asked were these: "Do you think the study is entitled to be called a science?" "In what department does it belong?" "What is its relation to political economy, history, political science, ethics?"

The question whether sociology is entitled to be called a science is answered by "fully three fourths" of the correspondents in the affirmative. Some hedge, by affirming that it is "becoming a science." Prof. John Bascom, of Williams College, appears to have entered into the humor of the situation; he writes, "It will do no harm to call it a science if we do not abate our effort to make it one."

The opinions regarding the department in which sociology belongs are entertainingly diverse. Prof. John Dewey, of the University of Chicago, is frank enough to admit that he doesn't "feel at all sure" where it belongs. "It would seem well," he adds, "to have it a separate branch, in order to make sure that it received proper attention." This feeling of uneasiness lest the claims of sociology be slightingly treated appears to be general among the representatives of the new study. Most of the teachers of sociology are of the opinion that it ought to form a department by itself. "Some would place it in the department of the social sciences, along with politics, economics, jurisprudence, and the like. Others would change the order, making all the social sciences divisions of sociology. On the other hand, Professor Giddings, of Columbia University, says: 'General sociology can not be divided into special social sciences, such as economics, law, and politics, without losing its distinctive character. It should be looked on as the foundation or groundwork of these sciences, rather than as their sum or as their collective name.' Scattering replies place it under psychology, moral and political science, political economy, and anthropology. One teacher thinks it belongs under the 'humanities'; while two say it has no natural boundaries, and is therefore not included in any one department." Altogether the impression left by the replies to this question is that the teachers of sociology are quite at a loss to know where to put the study in the university curriculum. They appear to realize confusedly that they have on their hands a pedagogical white elephant, which defies classification.

The opinions concerning the relation of sociology to political economy, history, political science, and ethics are almost delphic in their vagueness. Says one, "History is its material, ethics its guide, political economy its interpreter, and a rational system of political science its proposed end." Says another, "Sociology is political economy in practice, history in the making, political science as an art, and ethics applied." After worrying over these oracular epigrams it is refreshing to be told by another teacher that "the relation of sociology to political economy, history, etc., is *close*."

It would be superfluous to cite further illustrations of the unsettled state of sociological thought. The quotations that have been made show conclusively that the accredited representatives of the new "science" are at loggerheads upon fundamental questions. This fact the sociologists themselves readily admit. The author of a recent treatise on sociology speaks of the "confusion and perplexity among its teachers, and declares that its forms are as yet varied, and perhaps would suggest a series of pseudo-sciences instead if one genuine science." * Even Professor Giddings confesses in the preface of his Principles of Sociology that "much sociology is as yet nothing more than careful and suggestive guesswork." Professor Small, of the University of Chicago, in his Introduction to the Study of Society, speaks of sociology as an "inchoate science," and remarks that "only ignoramuses, incompetent to employ the method of any science, could claim for sociology the merit of a completed system."

Sociologists themselves, then, confess that differences of opinion exist among them. Let us look more carefully at the nature of these differences. They relate to the scope, the method, the object, and the ground-principles of the "science."

The province of sociology is defined by some very broadly, to include the whole range of the phenomena of human association. By others the scope of the study is limited to a narrower range of social phenomena. Among the latter, again, there are some who would identify sociology with the study of social origins, or the genesis of social institutions. Others would restrict sociology to a study of the history and function of the family. Still others understand by sociology merely the pathology of society, devoting themselves to the diagnosis of social diseases, as crime and pauperism.

Professor Giddings has called attention to the natural tendency on the part of each social philosopher to create a sociology in the image of his professional specialty. "To the economist," he says, "sociology is a penumbral political economy—a scientific outer darkness—for inconvenient problems and obstinate facts that will not live peaceably with well-bred formulas. To the alienist and the criminal anthropologist it is a social pathology. To the ethnologist it is that subdivision of his own science which supplements the account of racial traits by a description of social organization. To the comparative mythologist and the student of folklore it is an account of the evolution of culture."

The narrower conceptions of sociology, however, have been dis-

* Fairbanks. Introduotion to Sociology, p. 1.

carded by the best-known sociologists of the present time. There is a general tendency to adopt a broad definition of the province of sociology, to include in the field of investigation all the phenomena of social structure and growth.

But what is the relation of this general social science to the special social sciences—that is, the sciences dealing with special groups of social phenomena, as economics, politics, and jurisprudence? Is sociology anything more than a convenient collective name for the sum of all these? Touching this point opinions differ.*

At least three different conceptions of the relation of sociology to the various special social sciences may be distinguished. Sociology has been defined as (1) the "inclusive," as (2) the "co-ordinating," and as (3) the "fundamental" science of society. 1. The first conception is that of Spencer and De Greef. Spencer defines sociology as "the science of society," and defends his adoption of the term on the ground that "no other name sufficiently comprehensive existed." This implies that he conceives of sociology as an inclusive science. De Greef, the Belgian sociologist, makes the science all comprehensive; his scheme of classification "includes everything, from the husbanding of corn and wine to electioneering contests in the Institute of France." † 2. The second conception is that of Professor Small, of Chicago. He defines sociology as "the synthesis of all the particular social sciences." It does not include, it coordinates these sciences. It concerns itself with the relations which the various special groups of social phenomena hold to each other and to society as a whole, leaving to special social sciences the study of each group in minute detail. The conclusions won by these special sciences are taken by sociology and worked over into a body of correlated social principles. Sociology is, therefore, subsequent to the particular social sciences and dependent upon them. 3. The third conception is that of Professor Giddings, of Columbia University. He defines sociology as "the science of social elements and first principles." It is "not merely the sum of the social sciences; it is rather their common basis." It undertakes to analyze the general characteristics of social phenomena and to formulate the laws of social organization and evolution. Sociology furnishes a body of fundamental principles which make a common basis for the special social sciences. The latter rest on sociology, which is the antecedent and fundamental social science.

Now a little reflection will show that these three conceptions of sociology do not conflict, but harmonize. There is no real opposition

* See for the following: H. H. Powers. Terminology and the Sociological Conference, in Annals of the American Academy, March, 1895.

† See Giddings. Principles of Sociology, p. 29.

between them, rightly understood. Each emphasizes correctly one phase of the relation between sociology and the special social sciences. Sociology is both an inclusive, a co-ordinating, and a fundamental science. In the first place, sociology is a general science, having as its subject-matter social phenomena of all kinds. There fore it comprehends all the sciences dealing with special kinds of social phenomena. These particular sciences are, in the nature of things, closely related to each other. They must possess in common certain laws and principles. These it is the task of sociology to formulate; for as the inclusive social science it should exhibit the mutual relations of the included social sciences. Thus sociology becomes a co-ordinating as well as an inclusive science. Furthermore, the laws and principles of the special social sciences, which sociology, as the co-ordinating science, undertakes to formulate, are necessarily fundamental. And in this respect sociology may be regarded as the fundamental social science. The three rival conceptions of sociology must be combined in the correct view. As Mr. Arthur Fairbanks remarks in his admirable Introduction to Sociology: "Sociology may embrace all the sciences dealing with society, but it does not destroy the partial independence of any of these branches. It includes economics, politics, and the like, but, instead of supplanting them, its sphere is to lay the foundation of these particular social sciences."

It appears, then, that the disagreement among the leaders of sociological thought regarding the scope of their "science" is more apparent than real. The same may be said regarding the contention about method. The debate here is over the question whether deduction or induction is the proper method of investigation in the social sciences. One party holds that the only legitimate method is the abstract-deductive, the investigator arriving at his conclusions by reasoning *a priori* from certain fundamental assumptions regarding the nature of man in general. What these thinkers aim at is a subjective interpretation of social phenomena in terms of human motives, principles, and ideals. Another party maintains that the only fruitful method is the concrete-inductive, the investigator reaching his conclusions by observing the facts of social life and reasoning from them to general laws and principles. The aim here is to give an objective interpretation of society in terms of race, environment, and historical conditions. The controversy has been especially violent among the economists. The English classical school of political economy made exclusive use of the deductive method; economic laws were deduced from the fundamental postulate of human selfishness. The German historical school employed the inductive method; economic laws were inferred from a study of the concrete facts of industrial life.

This academic discussion over method is tiresome and futile. Neither method will ever drive the other from the field. The exclusive employment of either deduction or induction will yield only half results in the social sciences. The two methods effectually supplement each other and should be used together. They are not rivals, but allies. Induction without deduction is blind; deduction without induction untrustworthy. This fact is recognized by recent writers on sociology. So Professor Giddings remarks that "history without deductive illumination is chaos. Deduction without verification is undoubtedly the very light that never was on sea or land!"

The principal method in the social sciences must undoubtedly be the inductive. The nature of the subject-matter determines this. The social sciences deal with the facts of social structure and growth. The task of the investigator is the explanation of these facts. He has first, then, to observe and compare the facts. But his observation must be guided and his conclusions verified by deduction.

Concerning the purpose of sociology, as touching its method, there are two conflicting opinions. But here again the seeming disagreement is not absolutely irreconcilable. It is held by some that the purpose of the sociologist should be merely the acquisition of knowledge, without further thought of the practical use to which the results of his researches might be put. He should aim to discover and formulate the laws of social forces, not to propose ideals of social reform. Sociology is a pure science and has no utilitarian end. By others it is held that the purpose of the sociologist should be the regulation of social forces in the interest of human progress. The object of sociology is the betterment of society, the acceleration social evolution. It is an applied science and has a practical end.

Both these views are tenable. In fact, sociology, like all sciences, has a double purpose. The primary purpose is to acquire knowledge; the secondary purpose is to apply that knowledge to the attainment of practical ends. This duality of purpose is clearly set forth by Mr. Lester F. Ward in a recent essay.* "Sociology," he says, "has both a pure and an applied stage." It "should be studied first for the sake of information relating to the laws of human association and co-operative action, and finally for the purpose of determining in what ways and to what extent social phenomena may, with a knowledge of their laws, be modified and directed toward social ideals."

Modern society is a complex of difficult problems. And this fact furnishes a background of motive for the studies of the sociologist. Not even the veriest stickler for pure science can deny the imperative need of established knowledge of the laws of social activity. The

* Lester F. Ward. Purpose of Sociology. American Journal of Sociology, November, 1896.

people perish for lack of wisdom. To enlighten the public mind on vital social questions and thus to promote an intelligent direction of social conduct toward rational ends is the high function of sociology. This practical purpose, however, should be kept always secondary to the pursuit of knowledge. "The knowledge is the important thing. The action will then take care of itself." * The discussion of the what-ought-to-be must wait on the investigation of the what-is. The neglect of this caution has been responsible for much false doctrine and foolish counsel. Sociologists have allowed their enthusiasm for ideals to blind the eye and bias the judgment. Panacea hawkers of all sorts have attempted to prescribe for social diseases, without making any study of social structure and function. Communistic quackery has masqueraded as sociological wisdom. The wild-cat sociology of the present day is a result of the over-addiction to social reform which besets students of society. It can not be too strongly emphasized that the primary object of the sociologist is the impartial investigation of facts. The man who forgets this becomes dangerous. He is liable to run amuck.

The differences of opinion as to the scope, method, and purpose of sociology have been found upon examination to be less serious than they at first sight appeared. But in regard to the fundamental principles of sociology, the confusion is hopeless. The student will search in vain in the systematic treatises on sociology for any definite body of established doctrine which he can accept as the ground-principles of the science. He finds only an unmanageable mass of conflicting theories and opinions. Each treatise contains an exposition of what the author is pleased to label the Principles of Sociology. But the "principles" are not the same in any two treatises; and by no process of analysis and synthesis can they be brought into harmony. They are fundamentally contradictory. It is impossible, I believe, to discover a single alleged ground-principle of sociology that has commanded general assent.

Some of the recent writers on sociology have devoted themselves particularly to the task of establishing one basal principle which may be applied to the interpretation of all social phenomena. At least half a dozen claims to the discovery of such a principle have been put forward. Prof. Ludwig Gumplowicz finds the elementary social fact to be conflict; Prof. Guillaume De Greef finds it to be contract; M. Gabriel Tarde contends that the fundamental principle of society is imitation; Prof. Emile Durkheim argues that it is "the coercion of the individual mind by modes of action, thought, and feeling external to itself." Professor Giddings criticises all these explanations of society, as either too special or too general, and under-

* Ward. Ibidem.

takes to prove that "the original and elementary fact in society is the consciousness of kind." This is the determining principle to which all social phenomena are to be referred.* But Professor Giddings's sociological postulate has been promptly rejected by his American colleagues, Prof. Albion W. Small and Mr. Lester F. Ward. The former speaks contemptuously of the consciousness of kind as a remote metaphysical category, and declares that the whole system of sociology based on the principle is "an impossible combination of contradictions." † This opinion is approved by Ward, who riddles Giddings's book with criticism, and complains of the author's inability to handle principles correctly.‡

It is hardly necessary to penetrate further into this debate over first principles. The most exhaustive examination of the writings of the leaders in sociological thought would fail to discover any fundamental unity of opinion. The so-called principles of the science are multiform. They represent merely the unsupported conclusions of individual thinkers. If we except the barest commonplaces, no truths have been established; no scientific laws have been agreed upon. The content of the science of sociology, as expounded in treatises bearing this name, varies with the particular bias of the writer. In fine, there are systems of sociology galore, but there is hardly a sociology.

Of the various systems of sociology that have been developed since the new "science" was first outlined by Auguste Comte, that of Herbert Spencer is undoubtedly the most coherent and self-consistent. But even the genius of Mr. Spencer has been unequal to the task of working out a body of firmly grounded principles which should furnish a basis for the convergence of opinion on social questions. He has not succeeded in giving permanent form and content to sociology. His work is disparagingly criticised by other living sociologists. Small declares that "Spencer's sociology ends precisely where sociology proper should begin," and quotes approvingly De Greef's assertion that "Mr. Spencer not only fails to show that there is a place for sociology, but his own reasoning proves more than anything else that there is no social science superior to biology." * Ward, while commending the logical consistency of Mr. Spencer's work, pronounces him "unsystematic, nonconstructive, and nonprogressive." #

There is much justice in these criticisms of Mr. Spencer's system. His sociology is almost entirely descriptive; and his description of social phenomena has taken the form of an elaborate analogy between

* See Giddings. Principles of Sociology, chap. i.

† In American Journal of Sociology, September, 1896.

‡ In Annals of the American Academy, July, 1896.

Small and Vincent. Introduction to the Study of Society, p. 46.

society and the animal organism. The utility of this biological analogy has rightly been called in question. The particular resemblances traced by Mr. Spencer between a society and a living body are these: both grow and increase in size; while they increase in size they increase in structure; increase in structure is accompanied by progressive differentiation of functions; and differentiation of functions leads to mutual interdependence of the parts. Furthermore, in the case both of a society and of a living body the lives of the units continue for some time if the life of the aggregate is suddenly arrested; while if the aggregate is not suddenly destroyed by violence its life greatly exceeds in duration the lives of its units. Since, therefore, the permanent relations among the parts of a society are analogous to the permanent relations among the parts of an organism, society is to be regarded as an organism.

Now the trouble with this clever analogy is that it breaks down completely when the comparison is carried beyond a certain point. Mr. Spencer himself notices some differences between the social body and the animal body, but declares that they are not of such fundamental character as to weaken the force of his analogy. One of these differences, however, can not be so lightly dismissed. If we compare a high type of animal organism with a high type of society, this striking unlikeness is discovered. In the former there is but one center of consciousness; in the latter there are many. "In the one," to quote Mr. Spencer's own words, "consciousness is concentrated in a small part of the aggregate. In the other it is diffused throughout the aggregate." The animal body has one brain, one center of thought, feeling, and life; the social body has numberless such centers.

When we go back and compare the course of development in the two cases the difference noted comes into even greater prominence. The evolution of animal life is characterized by progressive centralization, the evolution of social life by progressive decentralization. In the lowest form of animal, the amœba, there is no single center of life. The life is in all the parts; reproduction takes place simply by division. But with each successive advance above this lowest form there is developed more and more definitely a single center of consciousness. One part becomes distinctly differentiated as the sole seat of life. If that part is destroyed, the organism dies. Thus, "animal development has meant a concentration of the more important nervous elements and a merging of their separate activity in the common activity of a single consciousness." *

The law of progress is quite the reverse in social development. At a primitive stage there is a marked subjection of the individual

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* Fairbanks. Introduction to Sociology, p. 44.

elements of society to a central authority, whether that of the patriarch, the tribal head, or the tribal assembly. The individual has no economic, legal, or moral independence. But as society develops, the control which the whole exerts over the parts through authority and custom is gradually diminished. The individuality of the members of the social body becomes more and more marked. Individual freedom and responsibility are definitely recognized. Thus, the development of society has meant "the development of individuality in each of its members." It is a development of persons; the "social consciousness exists only in the discrete social elements which have become individual." *

In a word, social evolution is accompanied by a growing individualization of the component elements of society, whereas animal development leads to ever-stronger concentration of the life of the organism in a single part.

This difference between the physical organism and society is fundamental and essential. It is far more striking than the superficial likenesses ingeniously adduced by Mr. Spencer. His analogy tends to obscure the real nature of social relations. Unless used with cautious qualifications it "suggests false and one-sided views" and thus hinders the progress of sociology. The biological analogy has, it may be conceded, a certain value as a convenient way of describing some of the aspects of social structure and growth. It may aid the student to comprehend certain facts, but, if followed blindly, it will lead him to overlook other facts of even greater importance.

The biological analogy has been carried to absurd lengths by some writers. There is wearisome enumeration of social aggregates and organs, and exhaustive description of the social nervous system. We learn that the individual may be either a communicating cell or a terminal cell, otherwise known as an end organ. The girl in the central telephone office acts as a communicating cell when she telephones to Mr. Smith a message from Mr. Brown. "But when, Mr. Smith having asked her the exact time by the chronometer in the exchange, she looks at the dial and reports her observation to him, she is primarily a terminal cell or end organ." † The lookout man at sea, on the other hand, is invariably an end organ. This is far-fetched and fanciful. To clothe mere commonplaces in the borrowed rags and tags of biological terminology is not social science, nor does it aid one to get a correct conception of social reality.

The unsettled state of sociological thought which has been here set forth is a natural result of the peculiar difficulties that stand in the way of the social sciences. These have been described by Mr.

* Fairbanks. Ibidem.

† Small and Vincent. Introduction to the Study of Society, p. 218.

Spencer with great fullness of illustration.* They arise from three sources—namely, (1) from the intrinsic nature of the facts dealt with; (2) from the natures of the observers of these facts; and (3) from the peculiar relation in which the observers stand toward the facts observed.

1. In the first place the peculiar nature of social phenomena is such as to render scientific observation difficult. They are not of a directly perceptible kind like the phenomena which form the subject-matter of the natural sciences. Quantitative measurement and experiment are not possible. Social facts "have to be established by putting together many details, no one of which is simple, and which are dispersed, both in space and time, in ways that make them difficult of access."

2. Again, to these objective difficulties are added the subjective difficulties resulting from the intellectual and the emotional limitations of the investigators. There is, very generally, a lack of intellectual faculty sufficiently complex and plastic to comprehend the involved and changing phenomena of society. The scientific judgment is disturbed by a variety of emotional prejudices, which Mr. Spencer classifies as the educational bias, the bias of patriotism, the class bias, the political bias, and the theological bias.

3. And, finally, the peculiar position which the sociological observer occupies with reference to the phenomena puts further obstacles in the way of trustworthy observation. The sociologist has to study an aggregate in which he is himself included. He is a member of society and can not wholly free himself from the beliefs and sentiments generated by this connection.

These peculiar difficulties which beset sociology have naturally impeded the development of the department compared with other branches of knowledge. They furnish adequate explanation of the unsettled condition of sociological thought which has been described in this paper.

In conclusion, it is hardly necessary to state that in the writer's opinion sociology is not, at present, entitled to be called a science. In order to establish the right of a body of knowledge to the title of science, the claimants must be able to show that they have a definitely bounded field of investigation, that they employ recognized scientific methods, and that they have established certain truths of unquestioned value. Sociology in its present state fails to meet these conditions. Its province is not yet agreed upon, its methods have been often unscientific, and its first principles are yet to be formulated. It is not, therefore, a science.

"Sociology," says one of its critics, "no more demonstrates its

* Herbert Spencer. Study of Sociology, chaps. iv to xii.

claim to existence as a science than astronomy would if we found some astronomers insisting that the sun went around the earth and others contending that the earth went around the sun." *

After all, the question whether sociology deserves to be called a science or not is one of merely academic interest. It has received far more attention than it really deserves. Nor will any amount of discussion upon this point help to make sociology a science. "It is safe to say," remarks the critic from whom we have just quoted, "that no great scientific work was ever done by a man who was fretting over the question whether he was a scientist or not. The work is the thing and not what it is called. On the other hand, no name can dignify a work which is petty and futile."

It is not by talking about it, but by working over it, that a body of knowledge is developed into a science. And sociologists would do well to heed the advice of Tarde, the French writer: "Instead of discoursing upon the merits of this infant—sociology—which men have had the art to baptize before its birth, let us succeed, if possible, in bringing it forth." †

A FEATHERED PARASITE.

By LEANDER S. KEYSER.

NOTHING could more clearly prove that a common law runs through the whole domain of Nature than the fact that in every division of her realm there seems to be a class of parasites. In the vegetable world, as is well known, there are various plants that depend wholly upon other plants for the supply of their vital forces. And in the human sphere there are parasites in a very real and literal sense—men and women who rely upon the toil and thrift of others to sustain them in worthless idleness.

In view of the almost universal character of this law it would be strange if these peculiar forms of dependence did not appear in the avian community. We do find such developments in that department of creation. Across the waters there is one bird which has won an unenviable reputation as a parasite, and that is the European cuckoo, which relies almost wholly on the efforts of its more thrifty neighbors to hatch and rear its young, and thereby perpetuate the species. Strangely enough, our American cuckoos are not given to such slovenly habits, but build their own nests and faith-

* The Nation, vol. lx, p. 351. Review of Small and Vincent's Introduction to the Study of Society.

† Quoted by Vincent in American Journal of Sociology, January, 1896, p. 487.

fully perform the duties of nidification, as all respectable feathered folk should. However, this parasitical habit breaks out, quite unexpectedly it must be conceded, in another American family of birds which is entirely distinct from the cuckoo group.

In America the cowbird, often called the cow bunting, is the only member of the avian household that spirits its eggs into the nests of other birds. The theory of evolution can do little toward accounting for the anomaly, and even if it should venture upon some suggestions it would still be just as difficult to explain the cause of the evolution in this special group, while all other avian groups follow the law of thrift and self-reliance.

The cowbird belongs to the family of birds scientifically known as *Icteridæ*, which includes such familiar species as the bobolinks, orioles, meadow larks, and the various kinds of blackbirds, none of which, I am glad to say, are parasites. The name *Molothrus* has been given to the genus that includes the cowbirds. They are confined to the American continent, having no analogues in the lands across the seas. The same may be said, indeed, of the whole *Icteridæ* family. It may be a matter of surprise to many persons that there are twelve species and subspecies of cowbirds in North and South America, for most of us are familiar only with the common cowbird (*Molothrus ater*) of our temperate regions. Of these twelve species only three are to be found within the limits of the United States, one is a resident of western Mexico and certain parts of Central America, while the rest find habitat exclusively in South America. A fresh field of investigation is open to some enterprising and ambitious naturalist who wishes to study several of these species, as comparatively little is known of their habits, and indeed much still remains to be learned of the whole genus, familiar as one or two of the species are. Their sly, surreptitious manners render them exceedingly difficult to study at close range and with anything like detail.

Are all of them parasites? It is probable they are—at least to a greater or less degree—except one, the bay-winged cowbird of South America, which I shall reserve for notice later on in this article. We might assert that our common cowbird is the parasite *par excellence* of the family, for, so far as I can learn from reading and observation, they never build their own nests or rear their own young, but shift all the duties of maternity, save the laying of the eggs, upon the shoulders of other innocent birds.

These avian "spongers" have a wide geographical range, inhabiting the greater part of the United States and southern Canada, except the extensive forest regions and some portions of the Southern States. The center of their abundance is the States bordering on the upper Mississippi River and its numerous tributaries. They occur only as stragglers on the Pacific coast west of the Cascade and Sierra Nevada Mountains. The most northern point at which they have been known to breed is the neighborhood of Little Slave Lake in southern Athabasca. In the autumn the majority of these birds migrate to southern Mexico, although a considerable number remain in our Southern States, and a few occasionally tarry for the winter even as far north as New England and southern Michigan.

The male cowbird looks like a well-dressed gentleman—and may have even a slightly clerical air—in his closely fitting suit of glossy black, with its greenish and purplish iridescence, and his cloak of rich metallic brown covering his head, neck, and chest. He makes a poor shift as a musician, but his failure is not due to lack of effort, for during courtship days he does his level best to sing a variety of tunes, expanding and distorting his throat, fluffing up his feathers, spreading out his wings and tail, his purpose evidently being to make himself as fascinating as possible in the eyes of his lady love. One of his calls sounds like the word "spreele," piped in so piercing a key that it seems almost to perforate your brain.

One observer maintains that the cowbirds are not only parasitical in their habits, but are also absolutely devoid of conjugal affection, practicing polyandry, and seldom even mating. This is a serious charge, but it is doubtless true, for even during the season of courtship and breeding these birds live in flocks of six to twelve, the males almost always outnumbering the females. However, if their sexual relations are somewhat irregular, no one can accuse them of engaging in family brawls, as so many other birds do, for both males and females seem to be on the most cordial terms with one another, and are, to all appearances, entirely free from jealousy. Who has ever seen two cowbirds fighting a duel like the orioles, meadow larks, and robins? Their domestic relations seem to be readily adjusted, perhaps all the more so on account of their lax standards of sexual virtue.

In obtruding her eggs into the nests of other birds Madame Cowbird is sly and stealthy. She does not drive the rightful owners from their nests, but simply watches her opportunity to drop her eggs into them when they are unguarded. No doubt she has been on the alert while her industrious neighbors have been constructing their domiciles, and knows where every nest in the vicinity is hidden. Says Major Charles Bendire: "In rare instances only will a fresh cowbird's egg be found among incubated ones of the rightful owners. I have observed this only on a single occasion." From one to seven eggs of the parasite are found in the nests of the dupes. In most cases the number is two, but in the case of ground builders the cowbird seems to have little fear of overdoing her imposition. Major Bendire says that he once found the nest of an ovenbird which contained seven cowbird's eggs and only one of the little owner's.

If parasitism were the only crime of the cowbird one would not feel so much disposed to put her into the avian Newgate Calendar; but she not only inflicts her own eggs upon her innocent victims, but often actually tosses their eggs out of the nests in order to make room for her own. Nor is that all; she will sometimes puncture the eggs of the owners to prevent their hatching, and thus increase the chances of her own offspring. Whether this is done with her beak or her claws is still an open question, Major Bendire inclining to the belief that it is done with the claws.

Her finesse is still further to be seen in the fact that she usually selects some bird for a victim that is smaller than herself, so that when her young hopefuls begin to grow they will be able to crowd or starve out the true heirs of the family. In this way it is thought that many a brood comes to an untimely end, the foster parents having no means of replacing their own little ones when they have been ejected from the nest. However, I am disposed to think that the cowbird's impositions are not usually so destructive as some observers are inclined to believe. I once found a bush sparrow's nest containing one cowbird and four little sparrows, all of which were in a thriving condition. The sparrows were so well fed and active that as soon as I touched the nest they sprang, with loud chirping, over the rim of their cottage and scuttled away through the grass. They were certainly strong and healthy, in spite of the presence of their big foster brother. Before they flitted away I had time to notice how the little family were disposed. The cowbird was squatted in the center of the nest, while his little brothers and sisters were ranged around him, partly covering him and no doubt keeping him snug and warm. They were further advanced than he, for while they scrambled from the nest, he could do nothing but snuggle close to the bottom of the cup, where he was at my mercy.

A wood thrush's nest that I found contained two young thrushes and two buntings. All of them were about half fledged. Being of nearly the same size, the queerly assorted bantlings lived in apparent peace in their narrow quarters. I watched them at frequent intervals, but saw no attempts on the part of the foundlings to crowd out their fellow-nestlings. The cowbirds were the first to leave the roof-tree. Thus it appears that the intrusion of the cowbird's eggs does not always mean disaster to the real offspring of the brooding family, but of course it always prevents the laying of the full complement of eggs by the builders themselves.

Even after the youngsters have left the nest the mother cowbird does not assume the care of them, but still leaves them in charge of the foster parents. It is laughable, almost pathetic, to see a tiny ovenbird or redstart feeding a strapping young cowbird which is several times as large as herself. She looks like a pygmy feeding a giant. In order to thrust a tidbit into his mouth she must often stand on her tiptoes. Why the diminutive caterer does not see through the fraud I can not say. She really seems to be attached to the hulking youngster. By and by, however, when he grows large enough to shift for himself, he deserts his little parents and nurses and seeks companionship among his own blood kindred, who will doubtless bring him up in the way all cowbirds should walk.

It is surprising how many species are imposed on successfully by the cowbird. The number, so far as has been observed, is ninety, with probably more to be added. Among the birds most frequently victimized are the phœbes, the song sparrows, the indigo birds, the bush sparrows, and the yellow-breasted chats. Even the nests of the red-headed woodpecker and the rock wrens are not exempt. Some species, notably the summer warblers, detect the imposture and set about defeating the purposes of the interloper. This they do by building another story to their little cottage, leaving the obtruded eggs in the cellar, where they do not receive enough warmth to develop the embryo.

While it is surprising that acute birds should allow themselves to be imposed on in this way, perhaps, after all, they look upon the cowbird as a kind of blessing in disguise; at least, he may not be an unmixed evil. They may act on the principle of reciprocity—that "one good turn deserves another." What I mean is this: In my rambles I have often found the cowbirds the first to give warning of the approach of a supposed danger. Having no domestic duties of their own, they can well secrete themselves in a tall tree overlooking the entire premises, and thus play the useful rôle of sentinel. This, I am disposed to believe, is one of the compensating uses of this parasite, and may furnish the reason for his being tolerated in birdland. And he *is* tolerated. Has any one ever seen other birds driving the cowbird away from their breeding precincts, or charging him with desperate courage as they do the blue jays, the hawks, the owls, and other predatory species? He evidently subserves some useful purpose in the avian community, or he would not be treated with so much consideration.

A young cowbird that I purloined from the nest and reared by hand did not prove a very pleasant pet. He was placed in a large cage with several other kinds of young birds. At first he was quite docile, taking his food from my hand and even allowing some of his feathered companions to feed him; but in a few weeks he grew so wild and manifested such a fierce desire for the outdoor world that I was glad to carry him out to the woods and give him his freedom. A young red-winged blackbird and a pair of meadow larks developed a different disposition.

The dwarf cowbird (*Molothrus ater obscurus*) is similar to his relative just described, except that he is smaller and his geographical range is more restricted. He is a resident of Mexico, southern Texas, southwestern Arizona, and southern California. His habits resemble those of the common cowbird. Another bunting, having almost the same range, although a little more southerly, is the red-eyed cowbird, which is larger and darker than our common cowbird and has the same parasitical habits.

In South America three species have been studied by Mr. W. H. Hudson, who, in collaboration with Mr. P. L. Sclater, has published a most valuable work on Argentine ornithology. One of these is called the Argentine cowbird (*Molothrus bonariensis*). It is a *bona fide*, blue-blooded parasite, and has been seen striking its beak into the eggs of other birds and flying away with them. The males, it is said, show little discrimination in pecking the eggs, for they are just as likely to puncture the cowbird eggs as those of other birds. Every egg in a nest is frequently perforated in this way. These buntings lay a large number of eggs, often dropping them on the ground, laying them in abandoned nests, or depositing them in nests in which incubation has already begun, in which cases all of them are lost. However, in spite of this wastefulness the birds thrive, thousands of them being seen in flocks during the season of migration.

And, by the way, a description of their habits by Mr. Hudson has thrown an interesting light on the subject of migration in the southern hemisphere. South of the equator the recurrence of the seasons is the exact reverse of their recurrence north of the equator, and therefore the breeding season of the birds is in the autumn instead of the spring; the flight from winter cold occurs in the spring instead of in the autumn, and is toward the north instead of toward the south. Thus, in February and March the Argentine cowbirds are seen flying in vast battalions in the direction of the equatorial regions—that is, northward—in whose salubrious clime they spend the winter. As our northern autumn draws near and the southern summer approaches these winged migrants take the air line for their breeding haunts in the Argentine Republic and Patagonia. At the same time the migrants of the northern hemisphere are pressing southward before the blustering mien of old Boreas. It all seems wonderful and solemn, this world-wide processional of the seasons and the birds.

Naturally, one would expect to find some other eccentricities in this aberrant family besides that of parasitism, and in this expectation one is not disappointed. There are two other species of cowbirds in the Argentine country—the screaming cowbird (*Molothrus rufoaxillaris*) and the bay-winged cowbird (*Molothrus badius*). The latter is only partly a trencher on the rights of other birds—that is, it is only half a parasite. Indeed, it sometimes builds its own nest, which is quite a respectable affair; but, as if to prove that it still has some remnants of cowbird depravity in its nature, it frequently drives other birds from their rightful possessions, appropriates the quarters thus acquired, lays its eggs into them, and proceeds to the performance of its domestic duties like its respectable neighbors. Its virtue is that it never imposes the work of incubation and brood rearing on any of its feathered associates, even though it does sometimes eject them from their premises.

But what is to be said of the screaming cowbird? Instead of inflicting its eggs on its more distant avian relatives it watches its chance and slyly drops them into the domicile of its bay-winged cousins, and actually makes them hatch and rear its offspring! This seems to be carrying imposture to the extreme of refinement, or possibly developing it into a fine art, and reminds one of those human good-for-naughts who "sponge" off their relatives rather than go among strangers. One can scarcely refrain from wondering whether grave questions of pauperism and shiftlessness ever enter into the discussion of "the social problem" in the bird community.

THE COLUMBUS MEETING OF THE AMERICAN ASSOCIATION.

By Prof. D. S. MARTIN.

THE Columbus meeting of the American Association for the Advancement of Science was looked forward to with considerable interest as the first in the new half century of that body. Would the impression and stimulus of the great semicentennial gathering at Boston last year be found to continue, or be followed by a reaction? The meetings west of the Alleghanies are always smaller than the eastern ones, and the brilliancy of the Boston meeting could not be looked for in any interior city. The general expectation was for an "off-year" gathering.

But only in point of attendance was this impression verified. The register of those present showed three hundred and fifty-three names—a good number for an interior meeting, very few of the Western gatherings having exceeded it. In all other respects the general feeling of the members indicates that the meeting was notably successful and enjoyable, and the remarks made by the writer a year ago as to the real value of the smaller and less conspicuous meetings he feels to have been well exemplified. It was a scientific working meeting, with enough of social intercourse and attentions to be delightful, but not distracting. In these aspects the "golden mean" was markedly preserved.

The arrangements of the local committee for the convenience of the members and the success of the meeting in general were remarkable in their completeness. Nothing seems to have been overlooked, and some advances were made upon any previous year. The daily programmes were well printed and on hand early every morning—a most important point, not always heretofore attained. A complete telephone service between the section rooms and the central hall was a feature of special advantage, each section reporting to headquarters every paper as it was taken up. This was then posted on a bulletin, so that any one could know at any time what was going on in each section. A great amount of delay and disappointment, that has often been felt by members anxious to hear certain papers in different sections, was thus entirely obviated. Columbus has set an example in this feature that must be followed in the arrangements for all future meetings. The entire service on these telephones was rendered not by professional operators, but by young lady students of the university, and it was well and gracefully done.

It is fitting also that recognition should be given to some who have been less prominent in the local arrangements, but have had a large share in their preparation. While the public resolutions of thanks have made well-deserved mention of the local committee and its officers, especially Prof. B. F. Thomas, the indefatigable secretary, it is known in Columbus that much of the planning and arranging was the work of Prof. Edward Orton, Jr., the son of the president of the meeting, and that very much is owing to his laborious activity in the perfection of the local adjustments.

The place of meeting was eminently pleasant and suitable—the wide campus and fine buildings of the Ohio State University. To members from the East it was a matter of great interest to see this noble institution, one of the best examples of the great educational enterprises of the central States. In his address of welcome at the opening of the association the president of the university, Dr. William O. Thompson, outlined the history of public education in the West as dating back to provisions in the "Ordinance of 1787," looking to educational advantages for the great

"Northwest Territory." The State University of Ohio is one of the youngest of its kind, but now one of the most important, among the States formed from that great region, although Ohio was the first to be organized into Statehood.

Among the numerous fine structures scattered over the broad area of the campus, one of the most interesting is Orton Hall, containing the collections in geology and archæology, which are very extensive, as well as the laboratories, workrooms, and classrooms of the geological department, and at present the University Library. Here the meetings of Section E (Geology and Geography) were held. In the adjacent Botanical Hall, with its greenhouses, etc., Section G held its meetings. But most of the sections met in Townshend Hall, where the telephone service above described connected all the rooms.

The Ohio State University not only welcomed and accommodated the association, but had a strong representation among the officers of the meeting. The venerable president, Dr. Orton, has long been professor of geology in the university, and his collections are displayed in the hall that so appropriately bears his name. Section C (Chemistry) and Section G (Botany) both had secretaries from the university faculty—Professors Weber and Kellerman, respectively—while the arrangements for the meeting have been already spoken of as largely due to Professor Thomas and Professor Orton, Jr.

The ladies' reception committee did everything for the comfort and convenience of the visiting ladies. Their musicale and garden party in the grounds were described as extremely enjoyable, and the provision of private carriages to convey ladies and aged members across the broad spaces of the campus to and from the entrances was a very delicate and highly esteemed convenience, especially on warm days. The association was favored in the weather, which, though somewhat hot out of doors, was not severe, and the rooms were pleasant and airy.

The excursions given to the members were all of them scientific; they were not merely pleasure trips. This point was a marked feature of the Columbus meeting, and one well worthy of future imitation as far as may be. Not every place, however, has such marked facilities in this respect. On Saturday, August 26th, three free excursions were provided to points of geological or archæological interest. They were about equally shared by the members, together with representatives of the local committee. One party left on Friday evening, passing the night at Sandusky, and going by boat thence to the celebrated islands of Lake Erie, there to see the wonderful glacial furrows in the corniferous limestone on Kelley's Island and the recently opened strontia cave on Put-in-Bay Island. These islands are also favorite pleasure resorts for the whole neighborhood, and the trip was one of great interest and enjoyment. Another party, on Saturday morning, went to points of special importance in the coal region of the Hocking Valley, under the direction of Mr. R. M. Haseltine, chief mine inspector of Ohio. At Corning the party went down into Mine No. 8, owned by the Sunday Creek Coal Company, which has recently been equipped with electric power generated by utilizing the waste gas from neighboring gas-wells. This is said to be the first mine in Ohio to improve this natural source of power. At a depth of sixty-five feet the visiting party were taken by mine cars to a point where a remarkably fine exposure has been made of a carboniferous "forest," with upright trunks of *Sigillaria* and associated forms of coal vegetation finely displayed. At a point somewhat nearer the entrance, but at a lower level, lunch was served by the company, in a chamber lighted by electricity, two hundred feet underground and a mile from daylight! Another mine was visited later, and the machinery and appliances examined; this was No. 16, at Hollister, owned by the Courtright Coal Company.

The third party went to Fort Ancient to examine the great aboriginal earthworks at that place, owned by the State, and in charge of the Ohio Archæological Society. Here, on a hill widely overlooking the Little Miami Valley, are some of the most extensive prehistoric works in the country. The State has purchased two hundred and eighty-seven acres, and of these about one hundred acres are included within the walls. These ramparts, overgrown with large trees, follow closely the contour of the hills, and show that, whatever their age, there has been no change and little erosion since they were built. Their form is very irregular, consisting of two main areas—a northern one, called the "new fort," rudely square, and a southern one, called the "old fort," rudely triangular—connected by a narrow portion, called the "isthmus," with crescent-shaped transverse walls crossing it, and high conical mounds at the entrance to the "old fort." From the main gateway of the "new fort," starting from two mounds, two parallel walls can be traced, exactly eastward, for half a mile or more. Irregular as these works are, from the contour of the hills and the course of the ravines that bound them, yet there is also seen at times in their shaping a singular exactness of orientation that is striking and suggestive. Their use is problematical, but they must have been defensive, although an enormous force would be required to hold them, as their entire circumference is three miles and a half. At one point within the "old fort," in front of the gateway to the "isthmus," was found a burial place where a number of skeletons lay as though thrown together, not carefully and separately buried. The suggestion is strongly made that this spot marks an unsuccessful attack by enemies, who were roughly buried where they fell. At other points graves have been found, some containing copper implements and overlaid with plates of mica. Great regret was felt that Mr. W. K. Moorehead, who has explored so extensively here and in the vicinity and has published such interesting accounts of Fort Ancient and similar remains, was unable to be at the meeting on account of severe illness.

The public spirit that has secured this spot for the State, and the work of the Ohio Archæological Society in caring for it properly, are matters for pride and congratulation, and evidences of the highest type of civilization. The society is clearing away the dense undergrowth so as to display the works and the trees upon them; is guarding and repairing the walls at points where injury has occurred by "washing"; has sunk a well in the "old fort," with fine water; and built a pavilion for visitors. Here lunch was served to the party, and addresses given by archæologists present and officers of the Archæological Society.

On Thursday a large number of the geologists spent most of the day in examining moraines and glacial phenomena near Lancaster, and in the evening nearly the entire association was taken by special train to see the gas-wells in the same neighborhood, at Sugar Grove, which were lighted and "blown off" for their benefit. The city of Columbus itself is to a considerable extent supplied with natural gas.

Turning to the proceedings of the meeting, there may be noted in the character of the papers certain tendencies which are independent of the association and belong to the general line of thought of the present, and doubtless yet more of the future. The papers presented may be roughly grouped into two classes: those relating to technical details, and those involving or seeking practical results and applications. Of course, there is no conflict between these two lines of thought and work—the latter, to be really attained being dependent upon the former—but there is this tendency distinctly shown, to consider scientific questions in their bearing on the welfare or the needs of humanity. Naturally, this aspect appeared more clearly in some of the sections than in others, but no one who looks over the titles in the daily programmes can fail to note it. The whole work of Section I (Social and Economic Science) is of this character, and it is marked in Sections G

(Botany), D (Mechanics and Engineering), and H (Anthropology). It would be impossible to mention all the papers bearing upon such relations; a very few only can here be noted, even of those that were important. In Section I no more suggestive title has ever been presented to such a body than that of Miss Cora A. Benneson, of Cambridge, Mass., on Federal Guarantees for Maintaining Republican Government in the States. Miss Benneson is a graduate in law, and has already achieved distinction in her profession in subjects relating to questions of government. In Section G, Prof. H. A. Weber, the secretary, read a paper on Testing Soils for the Application of Commercial Fertilizers—the outcome of twelve years' intercourse with farmers' institutes and many more years of experimentation—aiming to avoid unwise and unprofitable use of fertilizers on soils to which they are not adapted, and to provide ready and accurate methods of determination as to the needs and the capacities of soils. Sections D and I united to hear a paper before the former, by Principal Morrison, of the Manual Training High School, of Kansas City, Mo., on Thermal Determinations in Heating and Ventilating Buildings, with special reference to schools. These are merely given as instances. Agriculture, electrical appliances, educational methods, and social conditions, all received important attention.

Another paper of great practical moment was read before Section C by Prof. H. W. Wiley, chemist to the United States Department of Agriculture, and Mr. H. W. Krug, on New Products from Maize Stalks. Careful analyses of the pith and stalks of corn, and important suggestions as to their great utility in various ways, were presented. Some of these were very surprising, not only pointing out the value of these substances as fodder, when properly prepared and used, but in the realm of war as well as in peace, for protecting the sides of naval vessels as a light and most effective armor, and in the manufacture of smokeless powder of a superior quality. Professor Wiley claimed that from these hitherto almost waste products of American farms immense results may be obtained.

Very naturally, the recent war and questions connected with it called forth some striking contributions. Prof. William S. Aldrich, of the University of Illinois, addressed Section D and a large proportion of members from other sections on Engineering Experiences with Spanish Wrecks, and the story of the Maria Teresa. Professor Aldrich was connected with the United States repair-ship Vulcan, and described the remarkable character of that vessel—an entire novelty in naval warfare—with her complete outfit of engineering tools and machinery, even to brass and iron furnaces of large capacity. Never before, he said, had such castings been made on board ship, or a foundry operated on the ocean. The effects of the American rapid-fire guns on Admiral Cervera's ships were fully described and illustrated, and the paper closed with a vivid and detailed account of the floating of the Maria Teresa, her repairing by the crew of the Vulcan through five weeks of most difficult work, and the unsuccessful attempt to bring her to Norfolk, ending in her abandonment and loss. The public lecture of Wednesday evening was by Prof. C. E. Monroe, of Washington, D. C., on the Application of Modern Explosives, very fully illustrated. Detailed accounts were given of the manufacture of gun cotton and various recent forms of high explosives and smokeless powders. In regard to the use of the latter, Professor Monroe emphasized the fact that France and Germany had adopted smokeless powders in 1887, and Italy and England a year or two later, and characterized as "unpardonable" the fact that our own service was unprovided with any such material when we began the war with Spain. He further discussed recent and very important experiments in the matter of throwing from ordinary guns shells charged with high explosives, especially that known as Joveite, with which tremendous effects have been produced in penetrating the heaviest plating.

Very different in character was the interesting and pleasing programme carried out by the Section of Botany in memory of two eminent workers in bryology who were long identified with Columbus—Dr. William S. Sullivant and his colaborer, Prof. Leo Lesquereaux, who was eminent also in fossil botany. Wednesday was set apart as "Sullivant day," and was marked by an extensive display of portraits, books, and specimens, and a series of memorial addresses, with notes on the progress of bryology. Twelve North American species of mosses have been named for Dr. Sullivant, and specimens of all these, with drawings made by him, were loaned for this occasion from his collection, now at the museum of Harvard University. Sets of duplicates of these species, from the herbarium of Columbia University, were prepared and presented as souvenirs to the botanists in attendance. Some members of Dr. Sullivant's family were present, and naturally felt a very deep sense of gratification at such a tribute to his name and fame.

The address of the retiring president, Prof. F. W. Putnam, had a special interest in that it was the last official appearance of one who has been for so many years closely and prominently identified with the association as its permanent secretary, and whose presence and personality have seemed an essential element in every meeting. Professor Putnam, in opening, paid an especial tribute to the late Dr. D. G. Brinton, of Philadelphia, a former president and leading member of the association, devoted to the same branch of research with himself—North American ethnology—although holding different theories therein. Professor Putnam dealt with the prehistoric peoples of this continent, and argued for distinct racial types as expressed in the remains that they have left, and for resemblances as due to intercourse and mingling of tribes, and not to autochthonous development of arts and customs as the result of corresponding stages of evolution without contact or outside influence—the view maintained by Dr. Brinton.

There is not space here to dwell further upon many valuable papers and discussions. The Section of Geology had a full and interesting session, in which glacial phenomena, especially as displayed in Ohio, bore a considerable part. One of the papers had a very wide and painful interest for all Americans—that of Mr. E. H. Barbour, on the Rapid Decline of Geyser Activity in the Yellowstone Basin. Careful and extended comparison of the present state of the geysers and hot springs with that to be seen a few years ago shows that these wonderful and impressive phenomena have greatly decreased in both the amount and the frequency of their manifestations, and Mr. Barbour warned all who desire to witness anything of their grandeur to visit the region without delay, as the indications point to their speedy cessation as probable if not inevitable.

In reference to the future of the association, it is gratifying to observe that the various special societies, whose relations to the association were considered in the article by the present writer a year ago, have not only continued to hold their summer sessions in connection with that of the association, but have shown a very cordial spirit of co-operation, and that some others are proposing to affiliate in a similar way. This is as it should be; but there is in it also the suggestion of a broader and more definite relationship of all these special societies to each other through the medium of the association. The tendency is apparently toward affiliation and co-operation among them, and the American Association for the Advancement of Science could have no more fitting or useful function than as a sort of federative or representative body for all the others.

The next meeting is to be held in New York, two months earlier than usual—at the end of June. Both the place and the time were determined by the Paris Exposition. It was thought best to arrange the meeting so that it might easily be attended by the large number of scientists from all over the country who will be going abroad next summer. This plan is doubtless wise, although it is much to be regretted that the time—the last week in June—will cut off from attendance almost all the members who are teachers in public schools, who will be just then in the pressure of their closing days and examinations. The peculiar circumstances of the year, however, justify what would otherwise be a most unfortunate time. New York will do her best, and give the association a welcome worthy of the great metropolis of America.

SKETCH OF DR. WILLIAM PEPPER.

By LEWIS R. HARLEY.

PHILADELPHIA has long been regarded as the home of medical science in America. Here was founded the first medical school in the United States, among whose alumni are numbered some of the most brilliant names in the profession. The spirit of scientific research has always been most active in Philadelphia. Here Franklin made his experiments in electricity, and Rittenhouse observed the transit of Venus; while Rush, Morgan, Williamson, and Physick gave the city a name abroad as a great medical center. Each generation has contributed something to her fame as the abode of scientific culture.

In recent times no name has been so closely associated with the intellectual progress of the city as that of the subject of this sketch. Dr. William Pepper was reared in a scientific atmosphere. His father, William Pepper, the elder, was born in Philadelphia, January 21, 1810. He graduated with first honors at Princeton in 1829. He afterward studied medicine for a time with Dr. Thomas T. Hewson, and in 1832 graduated in medicine at the University of Pennsylvania. He then spent two years in study in Paris, and in 1834 he entered upon his profession in Philadelphia, where he rose rapidly in reputation. He was physician to the Pennsylvania Hospital for twenty-six years. In 1860 he was elected Professor of the Theory and Practice of Medicine in the University of Pennsylvania. He held this position until the time of his death, October 15, 1864. Dr. Pepper had two sons, who became distinguished in the medical profession. The eldest son, George, was born April 1, 1841, and died September 14, 1872. He graduated from the college department of the University of Pennsylvania in 1862, and completed the course in the Medical School in 1865. He served with distinction in the civil war, and died at the beginning of a successful professional career. Another son, Dr. William Pepper, the subject of this sketch, was born in Philadelphia, August 21, 1843.

Dr. Pepper received his educational training solely in the city of his birth, having graduated from the college department of the University of Pennsylvania in 1862, in the same class with Provost Charles C. Harrison, Thomas McKean, Dr. Persifor Fraser, and many other men prominent in university circles. He graduated from the Medical School in 1864, and at once began the practice of medicine. His connection with the University of Pennsylvania began in 1868, when he was appointed lecturer on morbid anatomy. From 1870 to 1876 he was lecturer on clinical medicine. In 1876 Dr. Pepper was given a full professorship of clinical medicine, in which he continued until 1887, when he succeeded Dr. Alfred Stillé in the chair of the Theory and Practice of Medicine.

During this early period of his career Dr. Pepper labored with untiring zeal in the practice of his profession, and he also became eminently successful as a teacher. In 1877 he set forth his views on higher medical education in an address at the opening of the one hundred and twelfth course of lectures in the University Medical School.* At that time a very low standard existed in the medical schools of our country, and Dr. Pepper, in his address, urged the following reforms:

1. The establishment of a preparatory examination.
2. The lengthening of the course to at least three full years.
3. The careful grading of the course.
4. The introduction of ample practical instruction of each student both at the bedside and in laboratories.
5. The establishment of fixed salaries for the professors, so that they may no longer have any pecuniary interest in the size of their classes.

It was a source of gratification to Dr. Pepper that he lived to see all these reforms in medical education adopted. On the extension of the medical course to four years he subscribed $50,000 toward a permanent endowment of $250,000. As early as 1871 he began to urge the establishment of a university hospital, the subject being first discussed in a conversation with Dr. H. C. Wood and Dr. William F. Norris. An appeal was made to the public, and Dr. Pepper was made chairman of a finance committee. By May, 1872, a splendid site and $350,000 for building and endowment had been secured. Dr. Pepper was selected as chairman of

* Higher Medical Education. The True Interest of the Public and of the Profession. By William Pepper, M. D., LL. D. Philadelphia: J. B. Lippincott Company, 1894.

the building committee, and work on the hospital was pushed so rapidly that it was ready for patients on July 15, 1874.

When Dr. Charles J. Stillé resigned the provostship of the university in 1881, Dr. Pepper was elected as his successor. The executive abilities which he had displayed in connection with the founding of the new hospital made him the natural choice of the trustees. Although his private practice had increased to immense proportions, besides being occupied with his duties as a clinical professor, Dr. Pepper accepted the provostship. To the duties of this office he devoted the best years of his life. The extent of his practice and the demands made upon his time by the university would have appalled an ordinary man, but his capacity for labor appeared to be without limit, his working day often exceeding eighteen hours. His administration was characterized by the unification of the various schools of the university, besides the founding and equipment of several new departments. In one of his annual reports Dr. Pepper defined the broad policy of the university in the following appropriate language: "The university is truly the voluntary association of all persons and of all agencies who wish to unite in work for the elevation of society by the pursuit and diffusion of truth." * In other words, Dr. Pepper regarded the functions of the university as not simply an institution of instruction, but also of research. To this end every effort was made to open up new fields of investigation and to widen the scope of the university. During his provostship thirteen new buildings were erected, and the following departments, or schools, were organized:

1. The Department of Finance and Economy.
2. The Department of Philosophy.
3. The Department of Veterinary Medicine.
4. The Department of Biology.
5. The Department of Physical Education.
6. The Department of Archæology and Paleontology.
7. The Department of Hygiene.
8. The Graduate Department for Women.
9. The School of Architecture.
10. The School for Nurses in the University Hospital.
11. The Veterinary Hospital.
12. The Wistar Institute of Anatomy and Biology.

Dr. Pepper took particular interest in the Department of Archæology and Paleontology connected with the university. For a number of years he was president of its board of trustees, while it

* Report of the Provost of the University of Pennsylvania, from October, 1892, to June, 1894. Philadelphia, 1894.

was largely through his efforts that the Babylonian Exploration Fund was formed.* It was Dr. Pepper's ambition to have at the university well-equipped laboratories that would offer an opportunity for original investigation in medical science. The establishment of the Laboratory of Hygiene, in 1892, was the first step in this direction, soon to be followed by Dr. Pepper's gift of the Laboratory of Clinical Medicine. This laboratory was founded in memory of his father, the late Dr. William Pepper. The gift is unique in that it is made for the purpose of promoting and stimulating original research, and improving the methods of diagnosing and treating the diseases of human beings. Another field of work in the laboratory is that of giving advanced and special instruction to men who have already obtained the degree of Doctor of Medicine. At the opening of the laboratory in 1895 Dr. William H. Welch, of Johns Hopkins University, said, "To the small number of existing clinical laboratories the William Pepper Laboratory of Clinical Medicine is a most notable addition, being the first laboratory of the kind in this country, and it is not surpassed by any in foreign countries." †

Dr. Pepper realized more and more every year that the vast extent of the university interests demanded the undivided activity of its head. In 1894 he resigned the office of provost, stating at the time that, as it became necessary for him to choose between administration work and medical science, his devotion to the latter determined his choice. His administration was an eventful one, during which the university evolved from a group of disconnected schools to a great academic body. In 1881 its property in land amounted to fifteen acres, while in 1894 it controlled fifty-two acres in a continuous tract. In 1881 the university property was valued at $1,600,000; in 1894 it exceeded $5,000,000. The teaching force in 1881 numbered 88 and the students in all departments 981; in 1894 the former were 268, and the attendance had reached 2,180, representing every State in the Union, as well as thirty-eight foreign countries.

Dr. Pepper became well known as an author on medical subjects. He founded the Philadelphia Medical Times, and was its editor for two years. In 1885 he edited a System of Medicine by American Authors, a work that has been considered a leading authority on medical subjects. He also edited a book of medical practice by American authors, and, with Dr. J. F. Meigs, issued

* See the article on Science at the University of Pennsylvania, in Popular Science Monthly for August, 1896.

† Proceedings at the Opening of the William Pepper Laboratory of Clinical Medicine, December 4, 1895. Philadelphia, 1895.

a work on Diseases of Children. He was Medical Director of the Centennial Exposition in 1876, and for his services he received from the King of Sweden the decoration of Knight Commander of the Order of St. Olaf.

Dr. Pepper showed an unbounded interest in behalf of any movement that would benefit the community in general. He was one of the first to realize the advantage that would accrue to Philadelphia should she become a museum center. The Philadelphia Commercial Museum was established in October, 1893, with Dr. Pepper as president of the board of trustees. The old offices of the Pennsylvania Railroad Company were leased, and exhibits were secured from the Latin-American countries, Africa, Australia, Japan, and India, forming the largest permanent collection of raw products in existence. Referring to the great value of the museum, Dr. Pepper spoke as follows in his address of welcome at the first annual meeting of the advisory board:

"It would seem clear, however, that no method of studying industries and commerce can be scientific and complete which does not include the museum idea as now comprehended. The museum aims to teach by object lesson the story of the world, past and present. The Biological Museum presents the objects of human and comparative anatomy, arranged scientifically and labeled so fully as to constitute the best text-book for the study of those subjects. The Museum of Natural History does the same in its field. The Museum of Archæology shows the progress of the race from the most archaic times, the different types of human beings, their mode of living, their forms of worship, their games, their weapons, their inplements, the natural products which they used for subsistence, in their industries, and in their arts, the objects of manufacture or of art which they produced, and the manner in which they disposed of their dead.

"The natural products and manufactured articles, which constitute the material of commerce, come necessarily into such a scheme, and the long-looked-for opportunity of establishing a commercial museum upon a truly scientific basis presented itself when, at the close of the Columbian Exposition at Chicago, it was possible, through the enlightened liberality of the municipal authorities of Philadelphia and the invaluable services of Prof. W. P. Wilson, to secure vast collections of commercial material, which was so liberally donated to the Philadelphia museums by nearly all the foreign countries of the globe."

It was Dr. Pepper's idea to have the University Museum and the Commercial Museum situated near each other, on the plan of the South Kensington Museum. To this end the City Councils, in 1896, passed an ordinance giving over to the trustees of the Commercial Museum sixteen acres of land for the erection of suitable buildings. When all the plans are carried out the city will have unrivaled facilities for the study of civilization, past and present.

One of the most enduring monuments to Dr. Pepper's zeal and generosity is the Free Library of Philadelphia. In 1889 his uncle, George S. Pepper, bequeathed the sum of one hundred and fifty thousand dollars "to the trustees of such Free Library which may be established in the city of Philadelphia." From the beginning Dr. Pepper took a warm interest in the Free Library movement. It was under his leadership that the library was organized, and he was made the first president of its board of trustees. Speaking of his activity in this direction, the librarian, Mr. John Thomson, said: "No detail was too small for his personal attention. No plan for its future growth was too large for his ambitious hope of both public and private support. The remarkable and rapid increase in the circulation of the Free Library, the multiplication of its branches, the organization of all its departments on a broad and generous plan, his success in enlisting a large number of able fellow-workers, his clear, plain statements to Councils and the city authorities, his activity in securing needed legislation at Harrisburg, were some of the results of that intelligent energy which enabled him to do so much and to do it so well." The bequest of the Pepper family has been supplemented by ample appropriations by the City Councils, and the Free Library is now one of the most important institutions in Philadelphia. The library at present has twelve flourishing branches, while the combined circulation of the system for the year 1898 was 1,738,950 volumes.

Dr. Pepper was also connected with many scientific bodies. He was Vice-President of the American Philosophical Society, and President of the first Pan-American Medical Congress in 1893. He was a Fellow of the College of Physicians; President of the Philadelphia Pathological Society from 1873 to 1876; Director of the Biological Section, Academy of Natural Sciences; President, in 1886, of the American Climatological Association; President of the Foulke and Long Institute for Orphan Girls; President of the First Sanitary Convention of Pennsylvania; and in 1882 he was a member of the Assay Commission of the United States Mint. He received the degree of LL. D. from Lafayette College in 1881, and from the University of Pennsylvania in 1893.

In 1873 Dr. Pepper married Miss Frances Sargeant Perry, a lineal descendant of Benjamin Franklin, and a granddaughter of

Commodore Oliver Hazard Perry. Four sons were born, of whom three survive—Dr. William Pepper, Jr., Benjamin Franklin Pepper, and Oliver Hazard Perry Pepper. Failing in health, Dr. Pepper went to California early in the summer of 1898, where he died of heart disease on July 28th of that year. His body reached Philadelphia on August 6th. Funeral services were held in St. James's Protestant Episcopal Church, after which the body was cremated, and the ashes interred in Laurel Hill Cemetery. The American Anthropometric Society received, by the conditions of his will, Dr. Pepper's brain. Among the members of this society were Dr. Joseph Leidy, Phillips Brooks, and Prof. E. D. Cope. The articles of membership of the Anthropometric Society require that each member contribute his brain in the interests of science.

Dr. Pepper's death was followed by many expressions of sorrow from learned societies in various parts of the world. One of the most beautiful tributes was the memorial meeting held in the city of Mexico on September 12th. The leading medical and scientific societies of Mexico assembled in the hall of Congress to do honor to the work and character of Dr. Pepper. President Diaz occupied the chair, and about him were gathered the leading citizens, officials, and scientists of Mexico. Representatives of the National Medical School and the Board of Health eulogized Dr. Pepper, while Hon. Matias Romero spoke of him not as a physician, but as an "altruist who had consecrated himself to doing good for his fellow-men."

In Philadelphia, steps have been taken to erect a substantial memorial to Dr. Pepper. At a memorial meeting, held on March 6th last, a proposition was made to place a statue of the deceased scientists on the City Hall plaza, after the style of the Girard Monument. A committee was appointed with power to raise funds for the proposed statue, the cost not to exceed ten thousand dollars.

One of the letters of William Pengelly, geologist, of Torquay, England, printed in the memoir published by his daughter, gives this sketch of Babbage, the mathematician and inventor of the calculating machine: "I then called on Babbage, and could not get away until after one. He is a splendid talker. He seemed much pleased to see me, and complimented me very much on my lecture (at the Royal Institution), in which he was evidently much interested. He is the most marvelous worker I ever met with. I never saw anything like the evidence of multifarious and vast labor which his 'workshop' presents; he sticks at nothing. One drawer full of riddles, another of epigrams, one of squared words, etc. . . . It is appalling! And then the downright fun of the fellow; it is almost intoxicating to be with him!"

Correspondence.

"DO ANIMALS REASON?"

Dr. Edward Thorndike's interesting account, in our August number, of his investigations touching the reasoning power of animals has brought us a large number of letters questioning some of the main conclusions set forth in the article, and criticising the method of the inquiry. Not having room for all these communications, we print one of them, and add extracts from two others. These represent the principal objections urged by the various writers against the conclusions drawn by the author of the article from his experiments.

Editor Popular Science Monthly:

Sir: The first reading of Dr. Thorndike's article Do Animals Reason? in the August Popular Science Monthly, gave the impression, which has been deepened by subsequent perusal, that his experiments were not only inadequate to solve the question, but unfairly chosen.

A dog or a cat, utterly hungry, is placed in a box, from which it can escape "by performing some simple (?) action, such as pulling a wire loop, stepping on a platform or lever, clawing down a string, or turning a wooden button."

In the first place, what tends to destroy the reasoning power more than utter hunger? This intense physical craving begets frenzy rather than reason. The more intense this primeval desire, the greater the demand upon primitive instinct for its satisfaction. In the open the cat will jump at a bird, the dog at a bone. If the bird be up a tree, the cat will climb; if the bone be buried, the dog will burrow. Climbing and burrowing are deep-rooted developments of the feline and the canine nature.

Put a dog or a cat, utterly hungry, in a box and hang a piece of meat outside. Instinct prompts a jump through the bars of the box at the meat, and the greater the number of unsuccessful attempts the less the likelihood of the animal with a gnawing stomach sitting down to scrutinize the mechanical construction of the box to the point of perceiving that by stepping on a lever it will open a door. How many millions of years did it take two-legged man to arrive at the perception of the use of the lever? Did the shaggy biped arrive at that perception by sitting down when utterly hungry and looking at a lever; or did he, through countless generations, by some such chance as lifting a stone with a stick, come to the knowledge of weight and fulcrum?

Put an anthropoid ape, some several degrees nearer man in intelligence than a cat, in a modern office elevator that moves by the push of an electric button, suspend the elevator between two stories, and what do you suppose that anthropoid ape will do?

Put a schoolgirl fresh from belles-lettres and matinées in the cab of a locomotive and tell her to run it to the next station. She can not but know that steam will make the wheels go round, but what will she do in the maze of throttles, handles, disks, and rods that confronts her? What will she do if utterly hungry?

Take a laborer from his pick and shovel on the railway embankment and put him at the desk of the general manager. He can read and write. Let the messenger boys and clerks shower him with the letters and telegrams that bombard that desk every day, and let him try to settle the questions to which they give rise.

Now, why can not the schoolgirl run the locomotive, the laborer the railroad? Because the relations of things necessary to the tasks have never been imprinted upon their registering cells; because, in the latter case at least, of the lack of power of co-ordination—that is, the lack of the power of abstract reasoning that the task involves.

Why can not anybody do anything as well as anybody else? Because certain relations have been more deeply impressed upon certain brains than upon others; because of the greater power of certain brains to co-ordinate certain relations, their greater ability to give concrete manifestation of the result of such co-ordination through the efferent nerves. Otherwise any one of us could design a bridge, compose a symphony, or organize a trust.

The oftener relations are impressed upon the registering cells, the more readily are those relations co-ordinated, provided the brain structure be of the requisite caliber. Reiterated impression through the ages of the relations between their needs and surrounding things, together with the development of structural capacity, has led the beaver to build his dam, the bee the honeycomb, the ant its village, the bird its nest. In each case the registered impressions have led to action made possible by long-continued contact between structure and environment; the actions are the result of development that has proceeded mite by mite through unknown time. The brain of neither bird nor beast nor man will immediately co-ordinate radically new impressions received in a radically new environment into coherent action that leads to definite result.

Here is an example within the writer's immediate knowledge: At the age of seventeen a boy entered the service of one of the large railway systems as a clerk in the passenger department. Through eleven years of enthusiastic and concentrated endeavor to master the details of the service he rose to the head of the clerical force—that is, the reiterated impression upon his brain cells of the functions of the passenger service led to that co-ordination which resulted in efficient action. Then he became employed in the office of a large coal-mining company. For several days it was with the utmost difficulty that he could bring his attention to bear upon the new tasks. While seated at the desk in the coal office the old railway problems would chase through his mind; when he began to write the initials of the Pittsburg Consolidated Coal Company, he would find that he had written the initials of the Pittsburg, Cincinnati, Chicago and St. Louis Railway Company; instead of the initials of the Pittsburg, Fairport and Northwestern Dock Company, the initials of the Pittsburg, Fort Wayne and Chicago Railway Company. The latter initials in each case would appear upon the paper before he knew it, actually without his knowing that he had written them. The entirely unfamiliar routine entailed by the custody of bank accounts, coal leases, deeds and contracts, reports of coal shipments, and the handling of vouchers, became adjusted in his brain bit by bit through many weeks, and it was months before he could co-ordinate the new impressions into broad and well-defined reasoning. If he had been utterly hungry through all the period of the new service, it might have taken years.

Now, what can be expected of a dog or a cat, whose mental processes have been adjusted by inheritance and experience to life in the fields and jungles, when placed in a box, utterly hungry, to study mechanical contrivances? It is manifest that if the brain of a dog or a cat would become adjusted to the radically unfamiliar steps necessary to release it from such a radically unfamiliar environment, that adjustment could only come by extremely slow degrees. Voluntary perception is almost beyond the limits of expectation, and the leading of the animal through the necessary steps would have to be repeated time after time before the impressions upon its brain would reach any degree of permanence, especially as its brain would be lacking in attention, and the repeated handling be an annoyance to it. But that by such tutelage the animals, or a proportion of them, arrived at a knowledge of the means necessary to escape from the box is shown by Dr. Thorndike himself. "If one repeats the process, keeps putting the cat back into the box after each success, the amount of useless action gradually decreases, the right movement is made sooner and sooner, until finally it is done as soon as the cat is put in." But he says: "This sort of a history is not the history of a reasoning animal. It is the history of an animal who meets a certain situation with a lot of instinctive acts. . . . Little by little the one act becomes more and more likely to be done in that situation, while the others slowly vanish. This history represents the wearing smooth of a path in the brain, not the decisions of a rational consciousness."

Wherein, however, does this differ from the manner in which hundreds of clerks in offices finally learn routine work and mechnically go through the motions necessary to its performance? Do not the actions of thousands of laborers in field and factory seem to proceed from a wearing smooth of a path in the brain, rather than from rational consciousness? Yet they can not be said to be devoid of reason. Is not a great proportion of the daily actions of any one of us gone through from force of habit, almost by instinct?

The word reason does not apply alone to the mental processes of a Helmholtz, but to the co-ordination, however slight, of relations that result in definite action even of a humble organism. Herbert Spencer has clearly shown that instinct and reason differ in degree and not in kind.

Dr. Thorndike lays stress upon the fact that a "cat which, when first put in, took sixty seconds to get out, in the second trial eighty, in the third fifty, in the fourth sixty, in the fifth fifty, in the sixth forty," etc., and remarks: "Suppose the cat had, after the third accidental success, been able to reason? She would then have, the next time and all succeeding times, performed the act as soon as put in." Not long ago the writer and a man whose high intelligence can not be questioned, in moments of relaxation were trying to do one of the familiar ring puzzles—endeavoring to separate a ring from two others of peculiar shape and then to join the three. After repeated trials, one would loosen it, but could not replace it; the other finally succeeded in replacing it, but could not loosen it. Then the one could replace it, but not loosen it; the other loosen, but not replace it, and each was closely watching the other all the time. It was half an hour or more before either could both loosen and replace the ring, occasional successful attempts not being repeated until after several succeeding failures. Contrast the relation of the brain of the dazed and indifferent and peculiarly bedeviled cat to the puzzle presented to it by the inside of the box with the earnest effort of the two men to solve the ring puzzle. Who has not found a task more difficult the fifth or sixth time than the second or third, and has only performed it with ease after repeated attempts of varying degrees of success and failure?

In conclusion, the writer begs leave to relate an incident, which has not before appeared in print, that profoundly impressed him with the belief that at least in one instance one particular animal displayed reason. One Sunday morning, a dozen years or more ago, he was standing on the bank of the Ohio River at the Sewickley Ferry. A family group, accompanied by a large Newfoundland dog, hailed the ferryman and got in his boat, leaving the dog, which persuasively barked and wagged his tail, on the bank. As the boat pulled out into the stream the dog whined, and then made ready to leap in after it. Then he stopped at the water's edge, and, with head down, gazed intently at the river for several seconds—it seemed a minute or more. Then he ran up the bank more than a hundred feet, stopped, looked at the receding boat, plunged into the stream, and swam vigorously. The current, bearing him down, made his course diagonal to the bank. A boy standing by my side said: "Isn't that a smart dog? If he'd been a crazy dog he'd have jumped in where he was, but he ran up the bank so the current wouldn't wash him down away from the boat."

But the dog, swimming with all his vigor, was borne past the boat when within twenty feet or so of it; he endeavored to straighten his course without success, and then, in a long semicircle, swam around to the near bank, landing two or three hundred feet below the place whence the ferryboat had started.

What this dog would have done if placed, utterly hungry, in a box from which he could only liberate himself by stepping on a platform or turning a wooden button, I do not know.

LOGAN G. MCPHERSON.

PITTSBURG, *August 3, 1899.*

MR. FREDERIC D. BOND, of 413 South Forty-fourth Street, Philadelphia, writes: Of the accuracy of Dr. Thorndike's experiments I have no doubt, but certain facts connected with them seem to deprive the observations of much of their relevance.

Dr. Thorndike states that he arranged his experiments to give reasoning every chance to display itself, if it existed, and to observe those in which the acts required and the thinking involved were not far removed from the acts and feelings of ordinary animal life. Of these experiments one of the chief was to determine whether and in what way a cat would escape from a box opening by turning a button. Now, I submit that in this and the succeeding experiments the conditions Dr. Thorndike fancied to exist by no means did so. Simple as the release of a door by a button seems to us, the apparent simplicity arises merely from our empirical knowledge of what does happen in such a situation. Actually to think out the rationale of the matter, as an animal having no experience either personally or from heredity would have to do, involves very complex mental processes. The environment of a human being is vastly different from an animal's, though of this fact we constantly lose sight in reasoning; of mechanical appliances and principles, for example, an animal knows nothing, and yet we are too apt to suppose it regarding the world with a store of ancestral and individual experiences utterly foreign to it; and then, on its failing to do what, in the light of such experience, seems to us easy, we proceed to call into question its possession of reason. . . .

That the cats did finally learn to escape shows, according to Dr. Thorndike, "the wearing smooth of a path in the brain, not the decisions of a rational consciousness." May I ask Dr. Thorndike what possible reason could a cat have to suppose that what happened once must needs happen again? Does Dr. Thorndike fancy his own knowledge of a million like matters was acquired by reason, and not empirically elaborated by processes of exactly the same sort as the cats went through? Let this experiment be tried on a healthy infant of two years, and I am of the opinion that the results would be the same as with the cat; yet the infant undoubtedly carries on "thinking processes similar, at least in kind, to our own," which Dr. Thorndike implicitly denies to his cats.

The chief cause of the inability of students to reach concordant results in this matter of animal intelligence appears to lie in a certain uncritical assumption often made. That all consciousnesses have a certain field of presentations, that to this field they attain, that because of it they feel and will, are fundamental facts; but the belief that attention or feeling or will differs *per se* in different consciousnesses, other than as the field to which they are at the moment related, differs—this is an utterly unwarranted assumption. According to the action of its environment, each conscious being must know the world just so far as is needed to conform its existence thereto, or else it must perish; but whether such knowledge, which is acquired by experience only, be quite small, as with animals, or somewhat larger, as with man, there is no reason to suppose that the attention, feeling, or will of the animal differs in itself from the same psychological state in man.

Mr. Andrew Van Bibber, of Cincinnati, Ohio, says: Animals, and especially wild ones, have no bank account or reserve, and have to face new conditions daily, and yet they make a living where man would starve.

When I was out in Colorado and Utah, years ago, I used to know of animals removing the bait nicely from dangerous traps without springing the trap. I knew of a dog who went over a mile to call his owner to the aid of a boy who had broken his leg, and who would not be refused till understood. This is brutish "instinct," is it?—something that Dr. Thorndike can't define. Will "instinct" teach a tired, half-starved horse to eat oats if you set them before him? Dr. Thorndike would say "Yes," but Dr. Thorndike would be wrong unless that horse knew from personal past experience what oats were. What animals learn (like the human animal) they learn chiefly by experience. They accumulate facts in their minds and use them.

I served in the cavalry of the Armies of the Tennessee and the Cumberland, and I know that instinct will *not* cause a hungry horse to touch oats unless he knows from his own experience what oats are. We used to capture horses in Mississippi which had never seen oats. It is all corn down there. We would bring them into camp tired out and hungry, and would pour out our oats for them. Not one of them would touch the oats. You could leave the hungry horses hitched for twenty-four hours before oats, and not one grain would they touch. They would stand there and starve. We had to throw up their heads and fill their mouths full of oats. If we stopped there, they would spit them out. We had to grab their jaws and work them sideways until they had a good taste. Then they understood, and ate oats right along. Plenty of such horses in Mississippi to-day. . . .

If Dr. Thorndike tried his intelligent "Experiment No. 11" with a two-year-old cat, why didn't he try it with a two-year-old human? I guess he would have found an equal amount of ignorance of the mechanism of door fastenings, which comes only with teaching, and would have produced only struggles and screaming.

THE TREND OF POPULATION IN MAINE.

Editor Popular Science Monthly:

Sir: In the article contributed to your magazine for the month of August on Recent Legislation against the Drink Evil, I notice what appears to me to be a misstatement of fact. The writer speaks of the results of prohibition in the State of Maine, and says, "In sixty-three years Maine has seen her commerce disappear and her population dwindle."

I have not investigated the matter of Maine's commerce, but I find that her population has not dwindled in any possible sense of the term during the period indicated above.

It is, perhaps, a common impression that Maine has had such an exodus of her people to other States of the Union that she has suffered a loss in population. What are the real facts of the case? The census taken by the Government in 1840 gave the State 501,000 people, and that taken in 1890, 661,000, which shows, during the interval between 1840 and 1890, an increase of

160,000. The increase in population even during the decade 1880–'90 was 13,000. Whether there has been a decrease since 1890 nobody at present knows, and will not know until the decennial census is taken next year.

In view of these facts, I feel justified in challenging the correctness of the gentleman's statement, quoted above. There can be no room for doubt that Maine has sustained considerable losses in population from farm desertion, but no statistics can be presented to show that the State has, during the time stated above, been dwindling in the number of people living within her borders.

J. Earle Brown.

Woonsocket, R. I., *August 17, 1899.*

Editor's Table.

EDUCATION AND CHARACTER-BUILDING.

It is many years ago now since Mr. Spencer, in his Study of Sociology, remarked upon the exaggerated hopes commonly built upon education. With the courage that is characteristic of him, he went counter to a current of opinion which was then running with perhaps its maximum force. He said that the belief in the efficacy of education to remold society had taken so strong a hold of the modern world that nothing but disappointment would avail to modify it. This was in the year 1872; since then the disappointment has in a measure come, and many are prepared to accept his views to-day, who, twenty-seven years ago, thought they proceeded from a mind fundamentally out of sympathy with modern progress. Facts indeed are accumulating from year to year to prove the soundness of the philosopher's contention that "cognition does not produce action," and that a great variety of knowledge may be introduced into the mind without in the least inclining the individual to higher modes of conduct.

We are reminded of Mr. Spencer's line of argument by an article lately published in the London Spectator, entitled Influence on the Young. The writer sees clearly that enthusiastic educationists undertake far more than they can perform. "The character forms itself," he says, "assimilating nutriment or detriment, as it were, from the air, which the parents or teachers, for all their pains, can in no way change." There seems indeed to be in the young, he remarks, a distinct tendency to resist influence. Father and son will be opposed in politics; very pious people too often find, to their sorrow, their children growing up far otherwise than they could wish. The man who is very settled in his habits is as like as not to have a boy who can not be persuaded to take a serious view of life. The most unexceptionable home lessons seem to be of no avail against the attractive power of light companions. Evidently, Nature is at work in ways that men can not control. If there is a law of "recoil," as the writer in the Spectator hints, we may be pretty sure it serves some good purpose. It introduces, we can see at once, a diversity which makes for the progress, and perhaps also for the stability, of society. Two practical questions, however, suggest themselves: (1) What can we reasonably hope from education? and (2) What can we do to make a wholesome *milieu* for the rising generation?

With regard to education, it is evident that we can not know the best it can do until it has been reduced to a science—until, that is to say, as a result of the joint labors of practical educators and psychologists, we can claim to possess a reasonable degree of certainty as to the best arrangement and sequence of studies and the best methods of stimulating the mind and imparting knowledge. Upon these important questions there is still considerable diversity of opinion. Some educators think we should be very sparing of abstractions in the instruction of younger pupils. Others are of a contrary opinion. Professor Baldwin, for example, in his little work on The Mind, says that "grammar is one of the very best of primary-school subjects." He also recommends mathematics. These are questions which, it seems to us, admit of being finally settled. Allowance must of course be made for the varying capacities of individual children, but this need not stand in the way of the establishment of some general doctrine as to the law of development of the human mind. We shall then further require a true theory of method in education, so that we may know by what means the best results in the imparting of knowledge and the development of the capacities of the individual mind may be obtained. Assuming that these vantage points have been gained, education should be for every mind an eminently healthful and invigorating process, which is more than can be said for the forms of education that have prevailed in the past. These, while developing certain faculties, have, to a great extent, stunted others—have indeed, in too many cases, fatally impaired the natural powers of the mind. A notable paper, which appeared in the first number of this magazine, was one by the late Dr. Carpenter on The Artificial Cultivation of Stupidity in Schools. Professor Baldwin, in the work already cited, seems to be of the opinion that the process of cultivating stupidity, or at least mental shiftlessness, is in full blast to-day in many of our secondary schools owing to the prominence given to language studies. The science of education must at least put an end to this, and insure that the youths who are committed to the public schools shall not be subjected to any mind-destroying exercises. We can hope, however, that it will do much more. The mind, like the body, grows by what it feeds upon; and it is hard to conceive that suitable kinds of knowledge could be imparted in a natural manner, so as to awaken interest and develop the perceptive and reasoning powers, without at least preparing the mind for the reception of right sentiments.

So much the science of education, when it is fairly established, may reasonably be expected to do. It will deal with the mind upon true hygienic principles. There remains the more serious question how such a moral atmosphere can be created as will incline the young to take a right view of knowledge and its uses. Knowledge, it is hardly necessary to say, is power, just as money is power; and it is quite as needful that the idea of social service should be associated with the one as with the other. The best social service which, perhaps, any man can render is to give to the world the example of high disinterestedness and general nobility of character; and knowledge should be valued not as conferring individual distinction, but according as it expands and liberalizes the mind. The poet Coleridge has said with some truth that

> "Fancy is the power
> That first unsensualizes the dark mind,
> Giving it new delights; and bids it swell
> With wild activity; and peopling air,
> By obscure fears of beings invisible,
> Emancipates it from the grosser thrall
> Of the present impulse, teaching self-control,
> Till Superstition with unconscious hand
> Seat Reason on her throne."

The mind having been "unsensualized," the next step is to moralize and humanize it, otherwise Reason on her throne may act not much more wisely than other monarchs have done. The classic example of the worship of reason is not reassuring as to the infallibility of the goddess. The question, then, as to how intellectual education and the education of the moral sentiments may go hand in hand is one that comes home to every member of the community. We all help to make the moral atmosphere and create the moral ideals of our time; and there is no use in looking for high standards in our colleges and other institutions of learning if we have low standards in our homes. The youth who hears nothing talked of at home but money is not likely to take much interest in instruction that does not bear directly on the question of making money. The youth who hears money spoken of in the home circle simply as a means of personal enjoyment and glorification will need something more than a few lectures on political or social economy to make him take a different view of it. We may employ excellent men and women as teachers, but their success from a moral point of view will always be limited by the general tone of the community.

It is evident, then, that no very special directions can be given for solving the problem with which we are concerned. Still, the posing of the problem and the indication of the conditions on which its solution depends may awaken in a few minds a new sense of their responsibility in the matter, and it is a gain for even one to go over to the right side. It would be quite as easy for *the whole* of society to live on a somewhat higher plane as it is for it to live on its present plane. It would simply mean that the average man would treat the average man a little better than he does now: whatever one gave he would thus get in return, and the burdens which are always associated with mutual distrust would be proportionately lightened.

The philosopher whom we began by quoting has indicated ways in which the craze for legislative short-cuts is working against the moral improvement of society. He holds that parental responsibility has been seriously impaired by legislative encroachments in the matter of education and otherwise. Book learning has become to the modern world a kind of fetich; and minds that ought to be in contact with the facts of life are stupefied, and so far prevented from getting their normal moral growth by being drilled in studies that bring no real profit. We can not bear the idea that one of our human brethren should not be able to read and write; but, provided he possesses these accomplishments, we ask no questions as to what use he makes of them. We have before us a police description of a criminal who graduated at one of the most celebrated universities on the Continent, who studied afterward for the Church, who was for several years an elder, and who possesses—so we are distinctly informed—fine literary tastes. The gentleman with all these advantages is a fugitive from justice. With all his knowledge and accomplishments he got no hold of the principles of right conduct, and—there are not a few like him. We need not only a science of education, but a science of government, the most valuable part of which will probably be that which shows us with demonstrative force what things government ought to leave alone. It is quite possible we should find the moral atmosphere materially improving if only the natural reactions between the individual and his environment were not interfered with. The course of Nature, we may feel assured, provides not less for moral than for mental growth, and if either process is defectively carried on we may safely attribute it to some ill-advised attempt we are making to improve on natural institutions. Science has done much for the world in the past, but it has yet to do much more. It will yet give us a light to our feet in matters educational and political, and will liberate us from many of the yokes and trammels we have foolishly imposed upon ourselves. Mankind will then look into the face of Nature and see in it a new beneficence and brighter promises for the future of the race.

THE AMERICAN ASSOCIATION AT COLUMBUS.

A fairly good attendance, with an unusually large proportion of men prominent in science, and most cordial welcome and painstaking care of the members by the Ohio Sate University and the citizens of Columbus, combined to make the forty-eighth annual meeting of the American Association for the Advancement of Science a most enjoyable and instructive one. The two features of the meeting which seem to deserve the most attention are: First, the tendency which was shown in every section to direct the papers and discussions to practical subjects, so that all could participate in the proceedings and each member feel justified in having a word to say in them; and, secondly, the perfect cordiality with which the association was received and the assiduous attention with which it was taken care of by the local committee. The smaller and apparently less important details, but at the same time those which so largely determine one's comfort in a strange community, were thoughtfully arranged, and to this alone much of the success of the meeting was due. The numerous excursions were not only exceedingly enjoyable, but were arranged in every case primarily for their instructive and scientific features, and an Easterner, at any rate, could not take any of them without learning something. Another feature of the meeting that was especially satisfactory was the possibility it afforded for the younger workers in science to meet their elders, who had hitherto led the way—who were present, as we have already said, in larger proportion than usual. The importance of this feature, as President Orton pointed out in these pages a few months ago, can not be overestimated. The instruction and encouragement which a new worker in the scientific field gains from a personal acquaintance with the older men who have already achieved success and reputation in his branch of science are obvious enough. With the increasing specialization which modern research is making absolutely unavoidable, the social feature of the annual gathering of such a company of scientists is coming to be its most important function. A slight extension of it might very readily lead to the adoption of a specific policy by the several sections of devoting at least a part of their time to such a general statement of what has been accomplished in their department or to some especially important work of general interest that some of the members have been engaged in as would be most instructive to the members of the other sections. In the earlier meetings of the association the sectional chairmen often made such presentations in their stated addresses, but as times and men have changed, the idea has been departed from and this feature has become an exceptional one. If it could be restored, in a modified if not an identical form, and made a regular part of the programme of at least one of the sections at each meeting, the interest would be greatly enhanced, and in this way the chemist, the geologist, the botanist, and the others could be given regularly an authoritative account of what is being done in the other branches of science, and an important step would be taken toward doing away with the unfortunate narrowing influence which special scientific work is too apt to exercise.

The fixing of the last week in June as the time for holding the next meeting of the association, which is to be in New York, is a departure from recent practice as to date, but, aside from the special reason for it in this particular case—the probability that many of the members will be at the Paris Exposition during the following August—the experiment seems a desirable one because of the almost invariably excessive heat to which August meetings are exposed.

Scientific Literature.

SPECIAL BOOKS.

Evidences are apparent in many quarters of a reaction against the headlong rush toward aggression and territorial aggrandizement in which the American people have allowed themselves to be carried away. For a time the lovers of the Constitution of the United States as the fathers of the republic left it and Lincoln glorified it were bewildered, stunned by the revolution suddenly precipitated upon us from Washington, while the people at large seemed to be wild with enthusiasm for they knew not what, and men suffered themselves to be led—they knew not whither. Very slowly the true patriots recovered their voices, and signs appear that the people are at last getting into a mood to listen to reason. President *David Starr Jordan's Imperial Democracy* * comes very opportunely, therefore, to call to the minds of those who can be induced to think some of the forgotten principles of American policy, and to depict, in the terse, incisive style of which the author is master, the true nature and bearing of those iniquitous proceedings to which the American people, betrayed by treacherous leaders, have allowed themselves to become a party. President Jordan was one of the first who dared, in this matter, to make a public protest agaist this scheme of aggression. His first address on the subject —Lest we Forget—delivered to the graduating class of Leland Stanford University, May 25, 1898, was separated only a few days in time from Prof. Charles Eliot Norton's exposure of the reversal of all our most cherished traditions and habits which the precipitation of the war with Spain had brought about. The two men must share the honor of leadership in the awakening movement. In this address President Jordan gives a true definition of patriotism as "the will to serve one's country; to make one's country better worth saving"—not the shrilling of the mob, or trampling on the Spanish flag, or twisting the lion's tail. Even so early he foresaw the darkness of the future we were bringing upon ourselves, and said: "The crisis comes when the war is over. What then? Our question is not what we shall do with Cuba, Puerto Rico, and the Philippines. It is what these prizes will do to us." This, with the wickedness of the whole business, is the burden of most of the other papers in the volume. In the paper

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* Imperial Democracy. A Study of the Relation of Government by the People, Equality before the Law, and other Tenets of Democracy, to the Demands of a Vigorous Foreign Policy, and other Demands of Imperial Dominion. By David Starr Jordan. New York: D. Appleton and Company. Pp. 293. Price, $1.50.

on Imperial Expansion we are told of three "world crises" in our history when we were confronted with momentous questions. The first was after the Revolution. The second came through the growth of slavery. The third is upon us now. "It is not the conquest of Spain, not the disposition of the spoils of victory which first concerns us. It is the spirit that lies behind it. Shall our armies go where our institutions can not? Shall territorial expansion take the place of democratic freedom? Shall our invasion of the Orient be merely an incident, an accident of a war of knight-errantry, temporary and exceptional? Or is it to mark a new policy—the reversion from America to Europe, from democracy to imperialism?" President Jordan has an answer to the question, What are we to do in the shape affairs have assumed? The right thing would be "to recognize the independence of the Philippines, under American protection, and to lend them our army and navy and our wisest counselors; not our politicians, but our jurists, our teachers, with foresters, electricians, manufacturers, mining engineers, and experts in the various industries. . . . The only sensible thing to do would be to pull out some dark night and escape from the great problem of the Orient as suddenly and as dramatically as we got into it." Yet President Jordan recognizes that some great changes in our system are inevitable, and belong to the course of natural progress. They must not be shirked, but should be met manfully, soberly, with open eyes. A paper on Colonial Lessons of Alaska presents as an object lesson the muss we have made with colonial government in that Territory.

Mr. *A. H. Keane's Man Past and Present* * is a part fulfillment of a promise held out in his Ethnology, the first volume of the Cambridge Geographical Series, that it might be followed by another dealing more systematically with the primary divisions of mankind. In it the "four varietal divisions" of man over the globe are treated more in detail, with the primary view of establishing their independent specialization in their several geographical zones, and of elucidating the difficult questions associated with the origins and interrelations of the chief subgroups. The work consequently deals to a large extent with the prehistoric period, when the peoples had already been fully constituted in their primeval homes and had begun their subsequent developments and migratory movements. The author has further sought to elucidate those general principles which are concerned with the psychic unity, the social institutions, and religious ideas of primitive and later peoples. The two principles, already insisted upon in the Ethnology, of the specific unity of all existing varieties of the human family and the dispersion of their generalized precursors over the whole world in Pleistocene times are borne in view throughout. Subsequent to this dispersion, the four primary divisions of man have each had its Pleistocene ancestor, from whom each has sprung independently and divergently by continuous adaptation to their several environments. Great light is believed to have been thrown on the character of the earliest men by the discovery of the *Pithecanthropus erectus*, and this is supplemented as to the earliest acquirements by Dr. Noetling's discovery, in 1894, of the works of Pliocene man in upper Burmah. The deductions made from these discoveries strengthen the view Mr. Keane has always advocated, that man began to spread over the globe after he

* Man Past and Present. By A. H. Keane, F. R. G. S. (Cambridge Geographical Series). Cambridge, England: At the University Press. New York: The Macmillan Company. Pp. 584. Price, $3.

had acquired the erect posture, but while in other physical and in mental respects he still did not greatly differ from his nearest of kin. As to the age when this development was taking place, agreement is expressed with Major Powell's remark that the natural history of early man becomes more and more a geological and not merely an anthropological problem. The human varieties are shown to be, like other species, the outcome of their environments, and all sudden changes of those environments are disastrous. In both hemispheres the isocultural bands follow the isothermal lines in all their deflections—temperate regions being favorable, and tropical and severe ones unfavorable, to development. Of the metal ages, the existence of a true copper age has been placed beyond reasonable doubt. The passage from one metal to another was slow and progressive. In art the earliest drawings were natural and vital. The apparent inferiority of the drawings of the metal period to those of the cave dwellers and of the present Bushmen is due to the later art having been reduced to conventions. The development of alphabetical writing from pictographs is briefly sketched. Thus light is sought from all quarters in dealing with the questions of the book, and due weight is given to all available data—physical and mental characters, usages, religion, speech, cultural features, history, and geographical range. The general discussion of these leading principles is brief but clear and comprehensive. The bulk of the volume, following them, is occupied with the detailed and minute studies of the four main groups of mankind—the Negro, Mongol, American Indian, and Caucasic—and their subgroups, the discussion of each being preceded by a conspectus showing its Primeval Home, Present Range, Physical Characters, Mental Characters (Temperament, Speech, Religion, and Culture), and Main Divisions. The text is full, clear, good reading, instructive and suggestive, and in it the author has sought to make the volume a trustworthy book of reference on the multifarious subjects dealt with.

GENERAL NOTICES.

THE fact that Mr. *Charles A. Dana* stood in close personal relations with Secretary Stanton and was officially associated with him during a considerable period of the war for the Union, and was also incidentally brought near Mr. Lincoln, gives whatever he may relate concerning the events of that period somewhat the air of a revelation from the inside. Accordingly, we naturally expect to find things narrated in his *Recollections of the Civil War* * that could not be told as well by any one else. The account given in the book relates to events in which the author was personally concerned. Mr. Dana had been associated with Horace Greeley in the editorial management of the New York Tribune for fifteen years, when, in April, 1862, Mr. Greeley invited him to resign. No reason was given or asked for the separation, and no explicit statement of a reason was needed. Mr. Greeley, having expressed in the beginning his willingness to let the secessionist "wayward-sister" States go in peace, was in favor of peace; Mr. Dana was for vigorous war. A correspondence was opened between him and Mr. Stanton in reference to public matters shortly after Mr. Stanton went into the War Department. Then Mr. Dana was intrusted with special commissions that carried him to the front and brought him in contact with the leaders of the army; and finally, in 1863, was appointed Assistant Secretary of War, an office he filled till the end of the contest. His narrative deals as the story of one having knowledge with questions of policy, with the critical phases of the hard conflict, with the perplexities and anxieties of the men charged with re-

* Recollections of the Civil War. With the Leaders at Washington and in the Field in the Sixties. By Charles A. Dana. New York: D. Appleton and Company. Pp. 296. Price, $2.

sponsibilities, with stirring scenes in the councils at the Capitol and in battle at the front, and with personal incidents of the men whose names the nation loves and delights to honor. All is related in the straightforward, fluent style, touching only the facts, of a writer who has a story to tell and makes it his business to tell it. The result of the reading of the book is to arouse a new appreciation of the abilities and virtues of those great men in their various walks of civil, political, and military life, who took our country through its supreme trial.

Mrs. *Arabella B. Buckley's Fairy-Land of Science* has stood the test of about thirty years' publication as one of the simplest, clearest, and best popular introductions to physical science. Originating in a course of lectures delivered to children and their friends, the thought of publishing the book was suggested by the interest taken in the lectures by all the hearers. It was a happy thought, and the carrying of it out is fully justified by the result. But thirty years is a long time in so rapidly advancing a pursuit as the study of science, and makes changes necessary in all books treating of it. The publishers of this work,* therefore, with the assistance of the author, have considerably extended the original volume, adding to it notices of the latest scientific discoveries in the departments treated, and amplifying with fuller detail such parts as have grown in importance and interest. A few changes have been made in the interest of American readers, such as the substitution, where it seemed proper, of words familiar here for terms almost exclusively used in England, and the introduction of American instead of English examples to illustrate great scientific truths. The book has also been largely reillustrated.

Some of the essays in Miss *Badenoch's True Tales of the Insects* † have already appeared in serials—two of them in the Popular Science Monthly. The essays are not intended to present a view of entomology or of any department of it, but to describe, in an attractive and at the same time an accurate manner, a few special features of insect life and some of what we might call its remarkable curiosities. The author is well qualified for her undertaking, for, while being an entomologist of recognized position, she has those qualities of enthusiasm in her pursuit and literary training that enable her to present her subject in its most attractive aspect. From the great variety of insect forms she has selected only a few for this special presentation, including some of eccentric shape and some of genuine universal interest. She begins with the strange-looking creatures of the family of the *Mantidæ*, or praying insects, or, as the Brazilians call the *Mantis*, more fitly, the author thinks, the devil's riding horse, which is characterized as "the tiger, not the saint, of the insect world." The walking-stick and walking-leaf insects, of equally strange appearance, but peaceful, naturally follow these. Then come the locusts and grasshoppers, which are more familiar, and the butterflies and moths, which attract the most attention and present such remarkable forms as the case-moths and the hawk and death's-head moths. The insects made subjects of treatment are described with fullness of detail, and the record of their life histories. The book is published in an attractive outer style, on thick paper, with thirty-four illustrations by Margaret J. D. Badenoch.

Prof. *Charles C. James*, now Deputy Minister of Agriculture for Ontario, defines the purpose of his book, *Practical Agriculture*,* to be to aid the reader and student in acquiring a knowledge of the science as distinguished from the art of agriculture—"that is, a knowledge of the 'why,' rather than a knowledge of the 'how.'" The author believes, from his experience of several years' teaching at the Ontario Agricultural College, that the rational teaching of agriculture in public and high schools is possible and would be exceedingly profitable, and that an intelligent knowledge of the science underlying the art would add much interest to the work and greatly increase the pleasure in it. The science of agriculture is understood by him to consist

* The Fairy-Land of Science. New York: D. Appleton and Company. Pp. 252.

† True Tales of the Insects. By L. N. Badenoch. London: Chapman & Hall. Pp. 253.

* Practical Agriculture. By Charles C. James. American edition edited by John Craig. New York: D. Appleton and Company. Pp. 203. Price, 80 cents.

of a mingling of chemistry, geology, botany, entomology, physiology, bacteriology, and other sciences in so far as they have any bearing upon agriculture. He has aimed in this book to include only the first principles of these various sciences, and to show their application to the art of agriculture. The subject is treated as it relates, consecutively, to the plant, the soil, the crops of the field; the garden, orchard, and vineyard; live stock and dairying; and, under the heading of "other subjects," bees and birds, forestry, roads, and the rural home. The appendix contains lists of trees and of weeds, and an article on spraying mixtures. Questions to be answered by the reader are attached to most of the chapters. The illustrations are well chosen and good.

Considerable information about the Philippine Islands and their inhabitants is given by Dr. *D. G. Brinton* in a pamphlet entitled *The Peoples of the Philippines.* Dr. Brinton's point of view is the anthropologist's, and accordingly, after a few paragraphs about the geography, geology, and history of the islands, he takes up their ethnology and describes their various peoples as they have been studied by the masters of the science and by travelers. Much valuable as well as interesting information is given respecting their manners and customs, languages, and literature, for the Tagals have had a written language from the earliest known times, and though their old literature does not amount to much they are to-day exceedingly facile versifiers.

The Open Court Publishing Company (Chicago) publishes *The Lectures on Elementary Mathematics* (*Leçons élémentaires sur les mathématiques*) of *Joseph Louis Lagrange,* "the greatest of modern analysts," in a translation from the new edition of the author's collected works by Thomas J. McCormack. These lectures, which were delivered in 1765 at the École Normale, have never before been published in separate form, except in the first printing in the Journal of the Polytechnic School and in the German. "The originality, elegance, and symmetrical character of these lectures have been pointed out by De Morgan, and notably by Dühring, who places them in the front rank of elementary expositions as an example of their kind. They possess, we might say, a unique character as a reading book in mathematics, and are interwoven with helpful historical and philosophical remarks." They present with great clearness the subjects of arithmetic and its operations, algebra, equations of the third and fourth degrees, the evolution of numerical equations, and the employment of curves in the solution of problems. The translator has prefixed a short biographical sketch of Lapouge, and an excellent portrait is given.

A book of *Observation Blanks for Beginners in Mineralogy* has been prepared by *Herbert E. Austin,* as an aid to the laboratory course, and is published by D. C. Heath & Co. (Boston, 30 cents). The laboratory course is intended to make the pupil familiar with the characteristics of minerals and the terms used in describing them by directing him to observe typical specimens and describe what he sees, and to develop his faculties of observation, conception, reasoning, judgment, comparison, and memory. A description is given of apparatus that may be home-made. The blanks follow, containing spaces for the insertion of notes under the heads of Experiment, Observation, Statement, and Conclusion.

In Volume No. XXX of the International Education Series—Pedagogics of the Kindergarten—a number of Froebel's essays relating more especially to the plays and games were printed from the collection made by Wichard Lange. A new volume of the series, *Friedrich Froebel's Education by Development,* includes another selection from Lange's publication, in which the gifts are more thoroughly discussed. "Again and again, in the various essays," the editor of the series says, "Froebel goes over his theory of the meaning of the ball, the sphere, the cube, and its various subdivisions. The student of Froebel has great advantage, therefore, in reading this volume, inasmuch as Froebel has cast new light on his thought in each separate exposition that he has made. . . . The essays on the training school for kindergartners and the method of introducing children's gardens into the kindergarten are very suggestive and useful. In fact, there is no other kindergarten literature that is quite equal in value to the contents of this volume." The few essays in Lange's volume that still remain untranslated are characterized as being mostly of an ephemeral character. With the publication of the present volume, of which, as of the Pedagogics, Miss Josephine Jarvis is the translator, a complete list of the original works of Froebel in English translations has been provided in the International Education Series of Messrs. D. Appleton and Company.

A useful manual for students in chemistry is the *Chemical Experiments* of Prof. *John F. Woodhull* and *M. B. Van Arsdale* (Henry Holt & Co., New York). It embraces directions for making seventy-five experiments with different substances and chemical properties, including oxygen and the air, hydrogen and water, chlorine and the chlorine family, acids, bases, salts, sulphur, nitrogen, carbon, carbon dioxide and the carbonates, fermentation, potash, and problems to illustrate the law of definite proportions. A title is given to each experiment, suggesting what is to be proved by it; the details of the process are given, and the pupil is left to do the rest, entering his particular observations and conclusions on the blank page opposite the text. Questions are appended, of a nature further to develop the thinking powers of the pupils, and tables or lists are added of the elements concerned in the experiments, weights and measures, apparatus, and chemicals.

The book *Defective Eyesight: the Principles of its Relief by Glasses*, of Dr. *D. B. St. John Roosa*, is the result of an attempt to revise The Determination of the Necessity for Wearing Glasses, published by the same author in 1888. It was found, on undertaking the work of revision, that the advance in our knowledge of the proper prescription of glasses, especially in the matter of simplicity in method, had been so great as to require a complete rewriting. In doing this the book has been very much enlarged, and illustrations have been introduced. The author hopes his manual may prove a reliable guide to the student and practitioner in ophthalmology, and may also be of interest to persons who wish to know the principles on which the prescription of glasses is based. The special subjects treated of are the measurement of visual power, presbyopia, myopia or short-sightedness, hypermetropia, corneal astigmatism, asthenopia, and the qualities of lenses. (Published by the Macmillan Company. Price, $1.)

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Fragments of Science.

Officers of the American Association for 1900.—The American Association, at Columbus, Ohio, elected as president for the next meeting, which is to be held in New York city, June 25 to 30, 1900, Prof. R. S. Woodward, of Columbia University. The vice-presidents-elect are: Section A (Mathematics and Astronomy), Asaph Hall, Jr., of Ann Arbor, Mich.; Section B (Physics), Ernest Merritt, of Ithaca, N. Y.; Section C (Chemistry), James Lewis Howe, of Lexington, Va.; Section D (Mechanical Science and Engineering), J. A. Brashear, of Pittsburg, Pa.; Section E (Geology and Geography), J. F. Kemp, of New York city; Section F (Zoölogy), C. B. Davenport, of Cambridge, Mass.; Section G (Botany), William Trelease, of St. Louis, Mo.; Section H (Anthropology), A. W. Butler, of Indianapolis, Ind.; Section I (Economic Science and Statistics), C. M. Woodward, of St. Louis. The permanent secretary is L. O. Howard, United States Entomologist, Washington, D. C.; General Secretary, Charles Baskerville, of Chapel Hill, N. C.; Secretary of the Council, William H. Hallock, of New York city. The sectional secretaries are: Section A, W. M. Strong, of New Haven, Conn.; Section B, R. A. Fessenden, of Allegheny, Pa.; Section C, A. A. Noyes, of Boston, Mass.; Section D, W. T. Magruder, of Columbus, Ohio; Section E, J. A. Holmes, of Chapel Hill, N. C.; Section F, C. H. Eigenmann, of Bloomington, Ind.; Section G, D. T. McDougal, of New York Botanical Garden; Section H, Frank Russell, of Cambridge, Mass.; Section I, H. T. Newcombe, of Washington, D. C. Treasurer, R. S. Woodward, of New York city.

Graphite.—An interesting account of the history and manufacture of graphite is given by E. G. Acheson in the June issue of the Journal of the Franklin Institute. In the year 1779 Karl Wilhelm Scheele, a young apothecary in the town of Köping, Sweden, discovered that graphite was an individual compound. It had up to this time been confounded with molybdenum sulphide. In 1800 Mackenzie definitely added graphite to the carbon group by showing that, on burning, it yielded the same amount of carbon dioxide as an equal amount of charcoal and diamond. Graphite in a more or less pure state is quite freely distributed over the earth, but only in a few places is it found under conditions of purity, quantity, ease of mining, refining, and transportation to market that permit of a profitable business being made of it. Statistics for the last six years (1890–'95) show an average yearly production of 56,994 short tons. The countries contributing to the supply were Austria, Ceylon, Germany, Italy, United States, Canada, Japan, India, Russia, Great Britain, and Spain. Great differences exist in the structure and purity of the graphites furnished from the various mines. There are two general forms—the crystalline and the amorphous. The product of the Ceylon mines is crystalline of great purity, analyzing in some cases over ninety-nine per cent carbon, while that of the Barrowdale mines is amorphous and also very pure. The chief impurity in graphite is iron. It is probable that the first use made of graphite was as a writing substance. The first account we have of its employment for this purpose is contained in the writings of Conrad Gessner on Fossils, published in 1565. Its present uses include the manufacture of pencils, crucibles, stove-polish, foundry-facing, paint, motor and dynamo brushes, anti-friction compounds, electrodes for electro-metallurgical work, conducting surfaces in electrotyping, and covering the surfaces of powder grains. For most of these purposes it is used in the natural impure state. The mining and manufacture of graphite into articles of commerce give employment to thousands of people. The mines of Ceylon alone, when working to their full capacity, employ about twenty-four thousand men, women, and children. The rapid increase in the use of graphite has led to considerable discussion in recent years regarding the possibility of its commercial manufacture. It has been made in a number of different ways in the laboratory, all, however, depending on the same fundamental principle—viz., the liberation of the carbon from some one of its chemical compounds, under conditions which prevent its reassociation with the same or other elements. Mr. Acheson, who has been working for several years in an endeavor to devise a commercially successful process of manufacture, found, somewhere back in 1893, that graphite was formed in the carborundum (electric) furnaces of the Carborundum Company of Niagara Falls. Since then he has been following up this clew, and now believes that "the only commercial way to make graphite is by breaking up a carbide by the action of heat." A building for its manufacture in this way, by the use of the electric furnace, is now in course of erection at Niagara Falls.

Commercial Education in England.*—It is only of comparatively late years that the Government has had anything to do with the education of the people. For some centuries back all English education was practically controlled by our two ancient universities —Oxford and Cambridge. They decided what subjects were to be taught, and how they were to be taught. The control they exercised over our English schools was an indirect one, but it was none the less effectual. The schools themselves were, like the universities, independent of Government, or, indeed, of any control. The principal of these are known as "public schools," though the term "public" has of late years also been applied to the public elementary schools. These are nearly all developments of ancient foundations. Winchester, founded in the fourteenth century, and Westminster, in the sixteenth, grew up under the shadows of great religious houses; Eton was established in the fifteenth century by the monarch, close to his own palace at Windsor; Harrow, which dates from the sixteenth century, is the most important example of the most numerous class of all privately

* From a paper read by Sir H. T. Wood, at the International Congress, on Technical Education, at Venice, May, 1899.

founded local schools—grammar schools, as they were generally entitled—which have developed beyond their original founders' intention, and have eventually come to attract boys from all parts of the kingdom. The best boys from all of them went to the universities, and the course of study which was most successful at the university was naturally the course of study which was preferred at the school. The *literæ humaniores*, which were the sum total of university education, included only Greek and Latin language and literature, mathematics, and logic. Science—I have now in my mind the education of but a single generation back—was ignored. The teaching of modern languages was perfunctory in the extreme; the same may be said of history and geography, while even English language and literature were almost entirely neglected. Now an education modeled on these lines was not ill suited for professional men—men who went from the university into law, the Church, or medicine. But it was by no means suited, especially when cut short in its early stages, for boys whose future destination was the counting-house or the shop. We are not met to consider the training of scholars, but the sort of education best adapted to the requirements of the ordinary man of business, and given under the limitations inevitable in the conditions of the case—that is to say, in a very limited period and during the early years of life—intended also not only to train the mind but to provide a means of earning a living. Commercial education must in fact be a compromise between real education and business training. The more it inclines to the former the better. With the growth of modern industry and commerce the necessity for a training better suited for the requirements of modern life became more and more evident, and the place was supplied, or partially supplied, by private-adventure schools, which undertook to provide the essentials of a commercial education. Of late years also some important middle-class schools have been founded by institutions like the Boys' Public Day Schools Company, and the Girls' Public Day Schools Company, the teaching in which is of a modern if not of a commercial character. The growth also of science had its natural and obvious effects on educational methods. Scientific teaching was introduced at the universities—it had been practically ignored at Oxford, and recognized at Cambridge only as a department of mathematics. The more important of our public schools introduced what was known as a "modern side," that is to say, an alternative course which a boy might take, and in which science, modern languages, and mathematics took the place, to a greater or less extent, of the classical languages. Other schools modified their whole curriculum in a like direction; others again almost abandoned the ancient knowledge in favor of the modern. Such, in briefest and baldest summary, is the condition at which our system of secondary education has now arrived. In the meantime, elementary education in England had been organized and systematized. At the beginning of the century elementary education was imparted to the children of the peasants and agricultural laborers in village schools, most of which were sadly inefficient. In the towns there were various charitable institutions for educating the children of those who were unable to provide education for themselves, and there were also what were known as ragged and parochial schools, which were more or less of the same character as the elementary schools of to-day. Early in the century several important societies were established—they were mostly of a religious character—for the improvement of elementary education. By their assistance schools were founded throughout the country. These were maintained by voluntary effort, and so gained their name of voluntary schools, though they received aid from the Government, an annual grant being allotted for the purpose. In 1839 a committee of the Privy Council was created to regulate the administration of Government grants for education, and this committee still remains the governing body of our education department. The Elementary Education Act of 1870, with later acts of 1876 and 1880, laid down the principle that sufficient elementary education should be provided for all children of school age, and established a system of school boards, which boards were to be and were formed in all districts where such sufficient provision for education did not exist. By a later act of 1891 education was made gratuitous as well as compulsory. We have, therefore, now two great classes of elementary schools—school-board schools, in which education is free, and voluntary schools, in which a fee may be charged. Both alike receive Government aid under certain conditions. As a rule the voluntary schools are connected with the Church of England or with one or other of the nonconformist bodies. The boards which control the board schools are elected bodies, and the teaching is undenominational.

Genius and Habit.—W. L. Bryan and N. Harter are the authors of an interesting monograph in the Psychological Review for July, from which the following paragraphs are taken: "There is scarcely any difference between one man and another of greater practical importance than that of effective speed. In war, business, scientific work, manual labor, and what not, we have at the one extreme the man who defeats all ordinary calculations by the vast quantity of work he gets done, and at the other extreme the man who no less defeats ordinary calculations by the little all his busyness achieves. The former is always arriving with an unexpected victory, the latter with an unanswerable excuse for failure. It has seemed to many psychologists strongly probable that the swift man should be distinguishable from the slow by reaction time tests. For (*a*), granting that the performances demanded in practical affairs are far more complicated than those required in the laboratory tests, it seems likely that one who is tuned for a rapid rate in the latter will be tuned for a rapid rate in the former, when he has mastered them. Moreover (*b*), a rapid rate in elementary processes is favorable to their fusion into higher unitary processes, each including several of the lower. Finally (*c*), a rapid rate in elementary processes is favorable to prompt voluntary combinations in presence of new emergencies. In face of these *a priori* probabilities, eleven years' experience in this laboratory (the first three being spent mainly on reaction times) has brought the conviction that no reaction time test will surely show whether a given individual has or has not effective speed in his work. Very slow rates, especially in complicated reactions, are strongly indicative of a mind slow and ineffective at all things. But experience proves that rapid rates by no means show that the subject has effective speed in the ordinary, let alone extraordinary, tasks of life. How is this to be explained? The following answer is proposed: The rate at which one makes practical headway depends partly upon the rate of the mental and nervous processes involved; but far more upon how much is included in each process. If A, B, and C add the same columns of figures, one using readily the method of the lightning adder, another the ordinary addition table, while the third makes each addition by counting on his fingers, the three are presently out of sight of one another, whatever the rates at which the processes involved are performed. The lightning adder may proceed more leisurely than either of the others. He steps a league while they are bustling over furlongs or inches. Now, the ability to take league steps in receiving telegraphic messages, in reading, in addition, in mathematical reasoning, and in many other fields, plainly depends upon the acquisition of league-stepping habits. No possible proficiency and rapidity in elementary processes will serve. The learner must come to do with one stroke of attention what now requires half a dozen, and presently, in one still more inclusive stroke, what now requires thirty-six. He must systematize the work to be done, and must acquire a system of automatic habits corresponding to the system of tasks. When he has done this he is master of the situation in his field. He can, if he chooses, deal accurately with minute details. He can swiftly overlook great areas with an accurate sense of what the details involved amount to—indeed, with far greater justice to details than is possible for one who knows nothing else. Finally, his whole array of habits is swiftly obedient to serve in the solution of new problems. Automatism is not genius, but it is the hands and feet of genius."

"A vague Impression of Beauty."—The following sentences occur in an article on The Real purpose of Universities in a recent issue of the London Spectator. They give so strange a picture of the ideals of the two leading English universities as to seem worthy of reproduction: "However, Dr. Hill made one statement for which we owe him a sincere gratitude. 'The excellence of the classics,' said he, 'lay chiefly in their complete uselessness.' . . . In this simple statement is expressed the true value of our old universities. They should be practically useless. They should not teach you to be a good carpenter or a skillful diplomatist. You can not march out of Oxford or Cambridge into any career which will return you an immediate and efficient income. . . . The other universities of Europe are prepared to cut you to a certain measure, or to render you technically competent. But our English universities have hitherto declined to discharge this humble function, save in rare lapses, from a noble ideal. They at least profess to accomplish a far greater task. There is a strange period dividing the man from the boy, which clamors aloud for intelligent discipline, and this discipline Oxford and Cambridge are anxious to supply. The undergraduate is too young to specialize, and not too old to receive instruction. When his period of training is finished he is asked to assume the heavy burdens of life, to discharge tasks which may be dull, and which are rarely concerned with what were once called the humanities. As he passes through the university he may not have the time nor the wit to become a sound scholar nor a profound mathematician. But he may, if he understand his privilege aright, linger for a while in the groves of 'practically useless' knowledge. He may learn what literature meant in an age when it was concerned only with the essentials of simplicity; he may read the lessons of history when history was still separate from political intrigue. And though he forgets his Greek grammar, though in middle life he can not construe a page of Virgil, yet he carries away from this irrational interlude a vague impression of beauty which no other course of education will ever give him." Even for the schoolmen "a vague impression of beauty," whatever that may mean, seems rather unpractical as an educational *ultima Thule*.

The Purple of Cassius.—There are few substances in the field of inorganic chemistry on which so much speculation and actual work has been expended as the so-called purple of Cassius. A recent article by Mr. C. L. Reese, in the Chemical News, contains some interesting information regarding this curious compound. Up to the present time there have, it seems, been two views held as to its chemical nature—one that it is a mixture of stannic acid and metallic gold; the other, that of Berzelius, that it is substantially a chemical compound of purple gold oxide with the oxides of tin possibly mixed with an excess of stannic acid. It has seemed very likely that the substance is a chemical compound of acid character, and that the solubility in ammonia is due to the formation of a salt, but it has been found that by oxidation of stannous chloride and by allowing very dilute solutions of stannic chloride to stand, the "hydrogel" of stannic acid separated out, which, on the addition of a few drops of ammonia, liquefied and so became soluble in water, just as the purple of Cassius does. There can therefore be no salt formation here. Some comparatively recent work by Richard Zsigmondy, however, seems to have finally cleared up the chemical nature of this curious substance. Its formation is explained by assuming that when stannous chloride is added to a sufficiently dilute solution of gold chloride the latter is immediately reduced to metallic gold while stannic chloride is formed. Generally after a few seconds the liquid becomes red, but the purple is not precipitated for several days, unless it is heated. The gold is not precipitated as a black powder because the stannic chloride formed is immediately hydrolized into hydrochloric acid and the hydrate of stannic acid. The latter prevents the aggregation of the gold particles, and the stannic acid remains in solution as a colloid, which on standing gradually changes under the influence of the dilute hydrochloric acid to an insoluble form, the "hydrogel" of stannic acid. By heating, this change takes place immediately. The properties of the purple of Cassius depend on the properties and character of the stannic acid present, and the great variety in the properties of the stannic acids, the ortho, the meta, and the colloidal mixtures of the two explain the many contradictions in the literature with reference to the properties of the purple of

Cassius. Zsigmondy says, "I look upon the knowledge that a mixture of colloid bodies can behave, under some conditions, as a chemical compound, and that the properties of one body in such mixtures can be hidden by those in another as the most important conclusion to be drawn from this work."

The Abuse of Unskilled Labor.—The number of diseases directly or indirectly due to continued long standing is especially numerous among women. The London Lancet, which nearly twenty years ago attempted to improve matters in this respect in the case of shopgirls, has again taken up the subject, and recently published an editorial urging customers of the shops to boycott those establishments where no sitting accommodations are provided for the clerks. It says: "We, as medical men, maintain that sitting accommodations are absolutely necessary for shopgirls. The only argument having even the semblance of legitimacy which we have heard put forward in defense of the nonprovision of seats is that sitting is conducive to idleness, but in this connection such a premise can not be permitted, for an employee would be bound to come forward when an intending purchaser entered the shop. . . . The very fact that in many shops she is not allowed to sit down is conducive to idleness—idleness of the worst kind, the idleness of pretending to do something while in reality nothing is being done. Can nothing be done to stop this—as we once called it without the least exaggeration or sensationalism —'cruelty to women'? To the true woman—the woman with feelings for her sisters, the woman of love and sympathy, the true woman in every sense of the word—we appeal for help in this matter. If such women would abstain from purchasing at shops where they see that the employees are compelled to work from morning till night without permission to rest from their labors even when opportunity occurs, we should soon see the end of a practice which ruins the health and shortens the lives of many of our shopgirls." That there is a certain amount of danger for women from long-continued standing, to the point of exhaustion, there is no doubt, and much can be done toward improving the present conditions in this respect and in other hygienic ways in the shops. The large influx of women during recent years into the counting-room and the salesroom gives such questions an increasing importance, especially in the less skilled positions where labor combinations for mutual protection are not possible. There has already been considerable agitation of the question in this country, and there still remains much to be done. But, as Lord Salisbury pointed out in causing the rejection of a bill for remedying present shop conditions in England, it is a question not suitable for legislation, and can only be settled through the indirect action of public opinion on the shopkeeper himself.

The Occurrence of Gold Ores.—The following paragraphs are from an article by H. M. Chance in the Engineering Magazine for July, entitled The Increasing Production of Gold: "Another reason for anticipating further increase in the production of gold is found in our better knowledge of gold ores, and of the conditions under which gold occurs in Nature. Until the discovery of the Cripple Creek district the occurrence of gold as tellurid in deposits of large extent and value was practically unknown. Gold was, of course, known to occur, sparingly in some ores, partially as a tellurid associated with other minerals; but such a mineralized belt as that at Cripple Creek was entirely unknown, and such deposits were not looked for by the prospector. Similarly, we now know of another class of gold ores in which the gold occurs apparently in some form chemically combined in a siliceous matrix, often approaching a true jasper or hornstone, and showing by analysis possibly ninety-five per cent of silica. Such ores show no trace of 'free' or metallic gold, and the presence of gold can be determined only by assay or analysis. A few such discoveries have recently been made, accidentally, by inexperienced persons, who had rock assayed from curiosity. Similarly again, in the last few years gold has been found in most unpromising-looking porphyry dikes—the very rocks prospectors the world over have regarded as necessarily barren because they almost invariably fail to show any 'free' or metallic gold by the miner's quick 'horn' or 'pan' test. But mining engineers and prospectors are learning that in a mineralized region gold may occur in any rock, and hundreds of prospectors are assaying all sorts of most unpromising-looking rock, satisfied that by assay alone can they determine whether a certain rock is gold-bearing or not. This persistent and more or less systematic work now going on in every mining district must result in the discovery of many valuable deposits in unexpected localities, and ultimately promises to add largely to the annual output of gold."

MINOR PARAGRAPHS.

THE investigations of F. E. L. Beal of the Food of Cuckoos and S. D. Judd of the Food of Shrikes in their relation to agriculture are published in a single bulletin by the Department of Agriculture. Mr. Beal finds that the food of cuckoos consists almost wholly of insects, of which he has found sixty-five species in their stomachs, and concludes that from an economical point of view they rank among our most useful birds; and, in view of the caterpillars they eat, it seems hardly possible to overestimate the value of their work. Mr. Judd finds, from a very extensive examination, that the food of butcher birds and loggerhead shrikes consists of invertebrates (mainly grasshoppers), birds, and mice. During the colder half of the year the butcher bird eats birds and mice to the extent of sixty per cent, and ekes out the rest of its food with insects. In the loggerhead's food, birds and mice amount to only twenty-four per cent. Its beneficial qualities "outweigh four to one its injurious ones. Instead of being persecuted, it should receive protection.

THE Engineering Magazine is authority for the following: "The wrecking of the steamship Paris on the coast of Cornwall and the difficulties encountered in attempting to save her while a number of her compartments forward are filled with water, lead Mr. Richards, in the American Machinist, to suggest the applicability of compressed air. 'There is a means of expelling the water from the filled compartments so obvious, and so certainly effective, that it seems unaccountable that some engineer has not suggested it before this. Close the hatches of the flooded compartments and drive the water out by forcing air in. It would not make the slightest difference how big the holes might be in the bottom, as the water would be expelled and kept out on the same principle as in the old-fashioned diving bell.' This suggestion carries with it a much larger and more important one—namely, the use of air pumps instead of water pumps to save a leaking ship while afloat. As Mr. Richards well remarks, the work of trying to pump out a leaky ship is not only enormously wasted while it is going on, but it is never finished. If, however, the water leaking into a compartment of a ship be expelled by pumping air into the space, the work is done so soon as the compartment is filled with air down to the level of the leak. After that point is reached the ship is safe, no matter how large the hole, and no further pumping is necessary."

CHLORATE of potash has always been regarded by manufacturers and chemists as a nonexplosive, and hence there has been little care taken in handling and storing it. A recent explosion, however, at a large chemical works at St. Helens, in England, seems to disprove this view. A storehouse containing about one hundred and fifty tons of chlorate in the form of both powder and crystals took fire, and almost immediately after the falling in of the roof an explosion of terrible violence occurred, the shock being felt over a distance of twenty miles. The chlorate works were entirely demolished. A large gas holder of the city gas works, containing two hundred and fifty thousand cubic feet of gas, was burst and the gas ignited. Eight hundred tons of vitriol was poured into the streets of the town by the wrecking of ten vitriol chambers in a neighboring alkali works. Houses were unroofed, and in the main streets of the town, a quarter of a mile away, nearly every plate-glass window was demolished. A theory accounting for the explosion, advanced by Mr. J. B. C. Kershaw, in the Engineering and Mining Journal, is that it was due to the sudden and practically simultaneous liberation of all the oxygen from such a mass of chlorate, combined with the restraining influence of the kegs (the chlorate was packed in kegs of one hundredweight each), and possibly also helped by the presence of much charred wood and the dense volume of smoke. Whatever is the true theory, however, it is evident that our belief in the nonexplosiveness of potassium chlorate must be modified.

NOTES.

A PIECE of experimental glass pavement was laid in Lyons, in the Rue de la République, last fall, and it is reported to have worn very well thus far. The silicate of which the pavement is composed is called by the manufacturers ceramo-crystal or devitrified glass. It may be finished in various colors and with a rough or smooth surface. The blocks are made by heating broken glass to a temperature of 1,250° C. and then compressing it by hydraulic power. The resulting compound is said to have all the qualities of glass except its transparency.

THE New York Agricultural Experiment Station reports of its analyses of sugar beets in 1898 that the average percentage of sugar in the samples analyzed is 14.2, with a coefficient of purity of 85. In general the yield of beets was between nine tons and twenty tons per acre.

AN altitude of 12,440 feet, or 366 feet greater than any attained before, was reached in the kite-flying experiments at Blue Hill Observatory, Massachusetts, on February 21st. The flight was begun at twenty minutes to four in the afternoon, with a temperature of 40° and a wind velocity of seventeen miles an hour at the surface. At the highest point reached by the kite the temperature was 12° and the wind velocity fifty miles an hour. Four improved Hargreave kites with curved surfaces, like soaring birds' wings, were used tandem, and the flying line was a steel wire.

THE first to be unveiled of a series of tablets to be fixed by the Municipal Council of Bath, England, to mark historical houses is on the house where William Herschel lived in 1780, and was officially unveiled by Sir Robert Ball, April 22d. In a little workshop at the end of the back garden of this house Herschel made his Newtonian reflector, and here he discovered Uranus.

ATTENTION is called by Dr. Martin Ficker to the fact, brought out in his experiments, that cultures of microbes are affected by the glass of the tubes in which they are made. By virtue of differences in composition, different sorts of glass give varying degrees of alkalinity to water in contact with them, and the activity of the bacteria they contain is correspondingly affected.

WE have to add to our obituary list of persons in whom science is interested the names of Professor Socin, late of the University of Leipsic, Orientalist, and author of Baedeker's Palestine and Syria and many special works on the Arabic language and dialects; M. N. Rieggenbach, correspondent of the Paris Academy of Sciences, Section of Mathematics, at Olten, Switzerland; Elizabeth Thompson, donor of liberal gifts for scientific purposes, at Stamford, Conn.; she contributed toward the telescope for Vassar College, was a patron of the American Association, and endowed the Elizabeth Thompson Scientific Fund; George Averoff, who died at Alexandria, Egypt, July 27th, leaving, among other bequests, £20,000 to create an agricultural school in Thessaly, and £50,000 to the polytechnic schools at Athens; Charles J. Stillé, ex-Provost of the University of Pennsylvania, under whose administration the institution took a great stride in its development; Mrs. Arvilla J. Ellis, an assiduous student of the fungi, who assisted her husband, J. B. Ellis, in preparing and mounting the five thousand specimens for the North American Fungi and the Fungi Columbiani, and more than two hundred thousand other specimens which were distributed to the botanists of the world, at Newfield, N. J., July 18th; M. Balbiani, Professor of Embryology at the Collége de France; Prof. Pasquale Freda, Director of the Station for Agricultural Chemistry at Rome; Dr. S. T. Jakšič, Professor of Botany and Director of the Botanic Gardens, at Belgrade; Dr. Carl Kuschel, formerly Professor of Physics in the Polytechnic Institute at Dresden; M. A. de Marbaix, Professor of Zoölogy and Anatomy in the Agricultural Institute at Louvain; Dr. N. Grote, Professor of Psychology and Philosophy in the University of Moscow and editor of a journal devoted to those subjects; Robert Wilhelm Bunsen, the eminent German chemist, of whom a fuller notice will be given; and Sir Edward Frankland, another eminent chemist (English), one of Bunsen's pupils, a member of the Royal Commissions on Water Supply and River Pollution, and author of researches on the luminosity of flame and the effect of the density of a medium on the rate of combustion, died in Norway, aged seventy-four years.

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