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THE EARTHQUAKE IN AMERICA.

In several respects the great earthquake which, on August 31, shook the eastern half of the United States, is remarkable beyond all others whose records have reached us. It suggests, though it does not actually demonstrate, the existence of a cause of earthquakes such as had not been before taken into account. It also raises the question whether those seismologists are right who assert that more earthquakes occur now than in former times, the increase in the number of recorded earthquakes being, they maintain, far greater than can be explained by the increase, great though that has doubtless been, in the care with which all signs of subterranean disturbance are recorded.

The earthquake of August 31 was preceded by certain signs of widespread subterranean activity which may not, indeed, have been connected with it, yet require to be recorded as among the indications to which we may have to attend in forming an opinion of the probable cause of the disturbance which presently followed.

Early on August 31 an artesian well 4 inches in diameter, which had been bored to a depth of 180 feet, near Belle Plains, Ia., suddenly burst, and immediately an immense volume of water was forced into the air to a height of several hundred feet. This increased in size until a stream of water fully 16 inches in diameter (or sixteen times the cross section of the boring) was formed. The rush of this stream was as irresistible as the action of dynamite. Two "rivers," the Mayor of Belle Plains announced in a despatch to Chicago on the afternoon of August 31, "have been formed by this water-burst, which are running through the town at the rate of twelve miles an hour, and are carrying everything before them." An attempt was made to insert 16-inch boiler iron tubes into the well; but they were instantly blown out, as if they had been straws, and hurled high into the air. Then the Iowans tried to fill up the opening of the well with sand and stone—fifteen cart-loads of stone were emptied into the well; but they were instantly blown out and forced upwards, as if by a bursting magazine of gunpowder. The same happened when bags of sand were cast into the well. The men of the North-Western Railroad sent a large gang of men—"navvies," as we should call them—to help to dam the outlet, and they were helped by the county bridge gang. But for more than a day no abatement in the flow of water was perceptible. To quote from an account in the Chicago newspapers, the rushing rivers formed by the flow of waters continued to wash the channel deeper and wider, while the basin formed by the immense volume of water spread so as to form a wide lake over the lowlands in the vicinity. Until September 3, when a slight diminution was for the first time perceptible, it was calculated that the daily flow amounted to five million gallons of water. On the 4th it was found possible to sink a cone and a tube to regulate the outflow; but the danger now remains that the whole region from beneath which this subterranean river burst forth may cave in.*

It may possibly be that there was no connection between this outburst in Iowa and the earthquake which followed a few hours after, and was felt over a part of this same region, and violently at places much farther away from the centre of disturbance. Still the coincidence is too remarkable to be left unnoticed.

In like manner there may possibly have been no real connection between the great earthquake and a remarkable disturbance in Montana, which preceded it by three days. On Saturday, August 28, at the very time when a great earthquake shook Greece and Italy, the Excelsior Geyser, in the Yellowstone Park, Montana, burst suddenly into violent activity. Four years had passed, during which it had been quiescent. Its activity four years ago was remarkable, but short lasting. Its recent outbreak was of a somewhat similar character. When we consider the distance of Montana from South Carolina it seems almost as difficult to imagine that there was any connection between the subterranean disturbances in these places, as to imagine that the Excelsior Geyser was affected by the earthquake in Greece. It is indeed difficult for persons in England to appreciate fully the enormous extent of the United States. Accustomed to see in atlases a map of the States, as there is a map of the German Empire, the idea is conveyed that the States form a country resembling a European country, instead of the whole of Europe, in extent. From the Yellowstone Park to Charleston, S.C., is a distance of about 1,800 miles, or some 200 miles more than the distance separating Athens from London.

Yet it must be remembered that the direct effects of the great earthquake at Lisbon were recognised over an even greater distance than this, having affected not only the northern part of the Scandinavian peninsula, but even the eastern shores of North America. The waves of disturbance which swept around South Carolina on August 31 last were felt in the most striking manner as far north as Milwaukee on the western shore of Lake Michigan; and we shall probably hear, ere long, of minor disturbances noted at much greater distances even than this.

Of other signs of an approaching subterranean disturbance I need say little here. In the States the opinion was commonly expressed that a certain stillness and heaviness in the air, which many said they had noticed for some time before the earthquake, indicated the disturbed condition of the earth's interior. We know that such an idea is entertained in volcanic regions, as by the inhabitants of Naples in regard to Vesuvius, and by the inhabitants of Palermo and Messina in regard to Etna. That such atmospheric peculiarities may justly be regarded as premonitions is likely enough, but that they are indications of disturbances actually in progress is only less utterly inconceivable than the doctrine gravely propounded in some quarters that the recent earthquake was caused by electrical disturbances, indicated after it had happened by the occurrence of a magnetic storm in New York (State). It seems very likely that when the underground conditions have for a long time been in a critical condition, tensions having accumulated

* In passing, I may notice how such cases as these demonstrate the eruptive power which may accompany the outflow of fluid matter from the earth. It is often assumed by geologists that the outflow of lava in the great eruptions of the tertiary era were quiet, although the forces which produced them may have been intensely energetic. Certainly any eruptive action which may have accompanied the outflow has left no trace of its effects; but in like manner any one who should visit Belle Plains a year hence would find no trace of the eruptive, geyser-like energy with which water was flung forth—only the signs of the great lake itself which the water formed.

until relief is required in some direction, the changes of atmospheric pressure, indicated by abnormal atmospheric conditions, may be as the last feather on the back of the proverbial camel, and may actually bring about the earthquake in the same sense that the touch of a feather on a hair-trigger may bring about the explosion of the gun. But the still and heavy air (as we are apt to call it, though usually the barometer gives a different account of the matter) tells us nothing of the state of the earth's interior. It only tells us that if the earth's interior is in a state of strong tension nearly balanced by resisting forces, a disturbance is very likely to follow the abnormal condition of atmospheric pressure. When we remember that an alteration of two inches in the height of the barometer means a change of half a pound in the atmospheric pressure on each square inch of the earth's surface, and that often the area beneath which the tensions resulting in an earthquake are at work may be twenty miles square, we see that such an alteration of atmospheric pressure as often precedes a great storm may very well serve as trigger-puller to the earth's imprisoned forces and bring about an earthquake. In a region ten miles square, there are one hundred square miles, each containing about three millions of square yards, in each of which are nearly thirteen hundred square inches. So that there are not far from 400,000 millions of square inches in a surface of ten miles square. Thus a difference of two inches in the height of the mercurial barometer on a surface of that area would mean nearly 200,000 millions of pounds', or 100 millions of tons', difference of atmospheric pressure. This would be a mere nothing compared with the tremendous pressures which such a portion of the earth's crust is able to sustain and resist. But regarded as a change of pressure, it would be a very potent factor in a nicely balanced contest between the earth's crust and the reaction of interior strains and tensions. One may represent the difference of atmospheric pressure even more effectively; perhaps as equivalent to a flood of water covering the whole of the one hundred square miles to a depth of more than 2¼ feet.

As regards magnetic and electric disturbances, it may suffice to mention that those observed on the present occasion followed the earthquake, and that it might be taken almost for granted that no great subterranean disturbances could possibly take place without electrical and magnetical phenomena of an unusual kind being observed. To imagine, as some have done, that a magnetical storm, even if it had chanced to precede an earthquake, could have brought the earthquake about, is almost as preposterous as that blunder which set the scientific world on the broad grin nearly a quarter of a century ago, when it was gravely suggested that the *Great Eastern*, then missing, might have gone down in the great magnetic storm announced at Greenwich!

The earthquake of August 31 was felt at Charleston at 9.55 P.M. It has been stated since that the wave of disturbance travelled from this region of greatest disturbance in all directions. But, as a matter of fact, the shock was felt earlier in places at a distance. I have before me the leading St. Louis paper for September 1, in which, in an article written before the news from Charleston had been received, the times recorded at various stations are indicated thus:—At St. Louis, 8.20; at Indianapolis, 8.52; at Nashville, 8.54; at New York, 8.57; at Detroit, 9; at Louisville, 9.13; at Cincinnati, 9.16; at Cleveland, 9.38; at Atlanta, 9.50; at Washington, 9.55. (The remark is added, reading strangely and sadly in the light of the news which arrived but a few hours later: "As has been usual with such phenomena in the United States, very little damage to property was done, and there was no loss of life.") It is barely possible, however, that in reality the shock thus timed was felt earlier in Charleston. For the hour mentioned above was not actually recorded. The people at Charleston were naturally little disposed to make time records when their lives seemed appallingly endangered. No telegraphic news of the disaster was sent out that night, insomuch that it was not until the morning of September 2 that the greater part of the States heard of the terrible effects of the shock in Charleston. The record by which the time of the chief shock was inferred was simply the clock of St. Michael's Church, which had stopped at 9.55 P.M.

COAL.

By W. MATTIEU WILLIAMS.

IN my last I described the usual methods of proving coal by boring, and some of the sources of peril to investors in new ventures. Also the reasons why the deepest part of the seam to be worked is chosen for sinking the pits. I should add that where the coal is near the surface, and the depth of the shafts is consequently small, a larger number of pits are sunk on a given area of land than where the coal exists at greater depths. The reason of this is simple enough. The sinking of shafts is costly, and the cost of course increases with the depth. Also the bringing of the coal from long distances underground to the bottom of the shaft costs more than short distances. Besides this, the work of ventilation becomes more and more complex the greater the area that is worked from one pair of pits. Thus the question of whether a given pair of pits shall continue to be used for winning larger and larger areas, or whether these shall be abandoned and a new pair sunk, is answered by calculating whether the saving that may be effected by shorter underground roads is sufficient to cover the interest on the capital required for the new pits.

The great ten-yard seam of the "Black Country" between Birmingham and Wolverhampton affords an example of numerous pits in proportion to area. This may be noted in passing through by rail. The pits there are not only numerous, but about the most primitive in the kingdom as regards all their appliances.

At Sandwell Park, near Birmingham, where, after many vicissitudes of hope and fear and serious speculations, risings and fallings of shares, a much deeper seam has at last been reached, a remarkable contrast may be observed.

The unsophisticated reader may wonder why I have in the above only spoken of pits, or a pair of pits or shafts, never of a pit or shaft in the singular. The reason is that a single pit or shaft is now illegal in this country. The Corsican butcher called us a nation of shopkeepers, and ignorant outsiders still believe that we, as a nation, sacrifice everything to the exigencies of trade and commerce, but those who choose to inquire and learn the truth will discover that when laws are demanded in which the claims of humanity come in collision with those of profit, British legislation provides for the former at the expense of the latter to an extent unparalleled by the legislation of any other country in the world, either ancient or modern. Our factory acts for the protection of women and children, and the machinery of factory inspectors to enforce those acts; our laws for the compensation of injured workmen, our severe enforcement of compensation for personal injuries on railways, our regulations concerning the loading of ships and the general protection of sailors, our prohibition of chimney-sweeping boys, our laws against using dogs as draught animals, our legislation prohibiting female labour and regulating boy labour in coal-pits, are far more stringent than those of any other country in Europe. It is purely for the protection of the poor collier that we compel the rich capitalist to sink two pits where otherwise, and in other countries, only one is necessary. As the cost of a pit may amount to ten, twenty, and in some cases to as much as fifty or sixty thousand pounds, this legislative interference with a fundamental industry is one of a multitude of refutations of the shallow Napoleonic libel still repeated by ignorant foreigners.

The object of the two shafts is to secure efficient ventilation throughout the mine, one shaft serving as an inlet for air, the "downcast" shaft; the other as an outlet, the "upcast" shaft. The object was formerly attained by dividing the shaft down the middle by a "bratticing" or perpendicular wall of woodwork. Brattices are still used in other countries, where the saving of rich men's capital is deemed more holy than the saving of poor men's lives. The catastrophe at Hartley, where a vibration or swing of the cage caused it to strike and wreck the brattice demonstrated the danger of this contrivance, and an Act of Parliament justly abolished it.

The diameter of ordinary modern coal-pits is from 8 to 12 feet; some reach 16 feet, and even more. Old pits of 4 to 5 feet diameter still exist, but are now very rare. In this country they are, with a few exceptions, circular. The exceptions are elliptical pits, which are more common in Belgium.

It is Goldsmith, if I remember rightly, who tells the story of an old paradoxical Chinaman who stopped strangers in the street and asked them which are the more durable, hard things or soft. On receiving the natural answer, he opened his mouth and showed that all his teeth were gone, while his tongue remained as waggish as ever. A similar paradox is presented in pit sinking. Within certain limits, the harder the rock to be penetrated the easier and less costly the sinking of a given depth of shaft. The reason of this is that a hard compact rock, such as the hardest among the coal measures, has only to be removed so as to cut through it a shaft of the required diameter. This being done, the rock itself constitutes its own pit wall. But when the rock is soft and friable, such as the shales that abound in the coal measures, an artificial lining wall must be built all round.

In ordinary cases this wall is made of brick. It is evident that the first excavation must exceed in diameter that of the final shaft by double the thickness of this brick wall. As it is unsafe to go beyond a certain depth in friable material without supporting it with this lining, the problem to be solved is that of building a tower of brick from the top downwards. If the ground is not very bad, this is done by first proceeding downwards (say from the compact rock) and making the shaft of the same diameter as or smaller than above. Having reached the depth of a safe stage, this portion is now enlarged sufficiently to allow for bricking, and then, as a foundation on which this brickwork is to be raised, kerbs or courbes*—*i.e.*, stout segments of wood, 4 to 6 inches thick perpendicularly, and the full horizontal width of the intended brick wall—are firmly jointed together, forming a stout wooden ring, which serves as a foundation or floor upon which the circular brick wall is built up until it reaches the finished portion of the shaft above. The bricks used are of good quality, and accurately shaped as segments of the circular wall required. The manufacture of such "wedge bricks" is a regular business, the makers keeping moulds for every required diameter.

But how to sink below this kerb, seeing that the kerb and all the wall that rests upon it must be supported while it is being undermined to build beneath it the next instalment of the tower? Where there is a wooden kerb above, safely resting on compact, reliable rock, this may be done by means of "stringing deals"—that is, planks nailed against the upper kerb or kerbs, and against each other if necessary to join them in a string—the lower end of the string being nailed to the lower kerb, which is thus supported firmly. The sinking then proceeds as before down to another kerb.

The worst of all troubles in sinking is that which occurs when "running ground" is reached, such as a deposit of gravel. This is bad enough when tolerably dry; but when it happens, as it usually does happen, that the gravel deposit is a subterranean waterway, the case is very serious. I cannot better illustrate the nature of this, and the mode of fighting it, than by telling the story of my own experience.

I was engaged as manager of the Leeswood works of the London, Leeswood, and Erith Oil Company. Trouble came upon us, in the first place, by a blow from America. There they "struck ile," and also struck us, their petroleum, distilled by nature, being of the same character as our distilled oil, but better in quality. When I commenced the distillation of this oil its wholesale price, refined, was 3*s.* 6*d.* per gallon, now it is about 7*d.* We could not produce it for less than 1*s.* 6*d.*, if we purchased cannel from our neighbours. When the price of American kerosine fell below this, our retorts and my vocation were superseded. But the company had purchased a lease of land supposed to be rich in cannel, and were sinking to it under the supervision of the late Samuel Blackwell, so well known in the Black Country by his commercial enterprise and his commercial misfortunes, and worthily respected in spite of the latter. He visited the works weekly. We had a good underground working foreman or "steward," whose name, of course, was Jones (the population of those parts consists of men, women, and Jones's, chiefly the latter).

Poor Blackwell's health gave way, he knew that his brain was failing under the pressure of trouble, and that he must presently resign. We were close friends, and he initiated me into the work to be done. I had already followed his instructions, and paid the men, &c., but was not a mining engineer. At last Blackwell collapsed suddenly, and with the help of the faithful Jones I did his work. This would have been easy enough had all gone well; but one night I was called up with the alarming intelligence that the pit had given way; the whole structure of brickwork had sunk some inches; the sinkers had come upon loose ground, and a total collapse was threatened. Either the shaft must be abandoned, or the entire structure so far as it had gone must be suspended from above.

This alternative was no novelty to old hands, though rather startling to myself. Jones was fully equal to the occasion. A broad kerb was made of extra thickness, and this was jammed under the base of the brickwork resting on the "gravel wash," which was firm enough vertically while undisturbed. The kerb was completed, each segment being firmly keyed to its neighbour. Strong beams were then placed horizontally under this, and fully spanning across. Similar beams were laid across the mouth of the shaft, and the top and bottom beams firmly connected by strong iron chains similar to those used for raising the coal, &c. Then the sinking was recommenced, but, as it proceeded downwards, the gravel trickled from the sides of the sinking into the intended shaft, and thus opened out a cavern on all sides far exceeding the diameter of the pit. The deeper the sinking, the greater the diameter of this drift cavity. As nearly as I can remember, about thirty feet of depth was thus worked out. My anxiety was serious, doubtless the greater from lack of familiarity.

When I descended the pit and looked upwards there was a brick tower about 150 feet high, suspended by the chains

* *Courbe* is the French name for this contrivance, and I may tell, in passing, that the Welsh miners use the French word, so far as pronunciation is concerned. How they would spell it I cannot say.

and the timber beams. It was completely undermined to a great distance beyond its base all around, although the drift of the gravel was checked by woodwork. It suggested the old story of the sword of Damocles: a more deadly weapon than a sword was hanging perpetually over the heads of the men as they worked below: a failure of the chains or the beams, or of the ground above, and the whole of this suspended tower must come crushing down, hopelessly burying all.

At last the gravel was fully pierced and solid rock was reached; then a stout kerb was laid, and a double wall, an inner cylinder of brickwork corresponding to the finished diameter of the pit, and another outside of this, leaving a space between all round. This space was puddled with clay, "coffered" as Jones called it, in order to keep back the water, which was especially abundant in the gravel. As the double wall advanced upwards, the space behind it was well and firmly filled and rammed. At last the suspending kerb was reached, and when firmly connected with the double tower below, the suspending apparatus was removed.

The coffering to keep out the water is variously devised. Sometimes "tubbing" is substituted for the above-described. This I understand is more frequently used now than formerly. *Cuvelage* is the French name. A detailed technical description of the various kinds of tubbing would be out of place here. It will be sufficient to state that both wood and iron are used; that "plank tubbing," effecting a result similar to cooper's work, is used; also solid wood tubbing, which, broadly speaking, may be described as a lining of kerbs well wedged and caulked at all their joints to make them watertight. Then there is iron tubbing, formed of cast-iron cylinders, which are let down in short lengths and line the pit. Other iron tubbing is formed of cast-iron segments carefully built in. It is always expensive, the cost amounting in deep and large pits to as much as about 50*l*. or 60*l*. per yard. When substituted for brickwork, it has to support the lining structure above, and must be strengthened accordingly as the depth increases. If coalpits were permanent structures, such iron tubbing would be quite inapplicable, as in spite of brick linings and other devices the iron is gradually corroded by the water, and by the gases from the ventilating furnaces. If, however, it lasts until all the coal within its reach is worked out, this is sufficient.

As two pits must, in this country, be available for the ventilation of every colliery, it is convenient in opening new ground to sink the pair simultaneously. One of the advantages of this is the facility afforded for ventilation during the sinking, as the pits are usually placed near to each other. Man is so constituted that he cannot simply bore a hole in the earth to any depth he pleases and remain therein. He must make arrangements for causing a current of air to rise, and another to simultaneously descend, or he will be suffocated by the exhalations from his own lungs and the earth around. In sinking a pair of pits near to each other this ventilation is easily obtained by descending until the air begins to foul, then driving a horizontal communication and establishing an upcast of air in one pit and downcast in the other. The methods of doing this and of producing, directing, and controlling subterranean air currents generally will be treated hereafter.

We understand the Amateur Photographic Exhibition held by the London Stereoscopic Company in the spring has resulted in a loss to them. This was fully anticipated by the directors when they inaugurated it; and that the Company, in the face of this knowledge, have given the amateur world a second exhibition is, we think, most enterprising, and will undoubtedly be appreciated by amateurs as it deserves. We have no hesitation in saying to those amateurs who may be amongst our readers that, in common fairness, they should reciprocate and make their purchases from the Company. We have seen and can vouch for the quality of the articles supplied.

THE RECENT TOTAL SOLAR ECLIPSE.

FAR the most interesting results obtained during the recent eclipse are (1) Tacchini's discovery that the spectroscopic method of observing the sun's coloured prominences shows only the brighter parts of the prominences as they actually exist and as they are seen during totality. He observed the eclipsed sun through a telescope 6 inches in diameter, and noted (as during the eclipse of 1882) the existence of whitish extensions around and above the ruddy flames. Making spectroscopic study round the edge of the sun's disc after the eclipse, he found that the ruddy part—so to speak—the *core* of these prominences, was all that could be seen of them by the spectroscopic method. This discovery seems only explicable by the theory that the ruddy, jet-like portion of the prominence owes its light, and therefore its heat, to the velocity of outrush with which ejected matter passes through the hydrogen and helium already outside the sun, and not to the outrush of those gases themselves in an intensely heated condition. For, outrusting gases brought from a region of great pressure to a region of very small pressure would expand rapidly and be quickly cooled, so that the outlines of the heated and luminous portion would be sharply defined, and would be surrounded by a region not only cooler than the ejected matter, but even cooler than the surrounding atmosphere. On the other hand, ejected matter would travel outwards with diminishing velocity owing to the retarding action of solar gravity, while such portions as returned after reaching a certain height would not only be scattered around somewhat widely, but would reach the sun's surface with less velocity than they had had at leaving it, because of the effects of frictional resistance. Hence, above and around the region of rapid outrush, intense heat, and brilliant light, there would be a region where the hydrogen and helium in the sun's atmosphere would be heated by the rush of matter through it, and would therefore be luminous, but would be less heated than the region of outrush. This exactly corresponds with what Tacchini has discovered.

We should expect, as a further consequence, that the corona would show a gradual diminution of heat with increasing distance from the sun's edge, and therefore a gradual change of spectrum, those spectral lines brought out in the laboratory with high temperatures being shorter in the coronal spectrum than those visible when lower temperatures are employed. This was observed first in the eclipse of 1882. But the observations by Messrs. Turner and Perry, by which, on the present occasion, the results of 1882 were confirmed, must be regarded as of considerable importance, though not altogether new. An attempt has been made to reconcile the observation with the old and exploded theory that the corona is a solar atmosphere; and strangely enough the attempt has been made in the very same quarter where the idea was longest and most obstinately maintained that the corona is not a solar appendage at all. Whatever else we may surmise about the corona, we cannot any longer admit the possibility that it is of the nature of a solar atmosphere properly so-called. Gaseous matter is there in plenty, but it can no more form a solar atmosphere than can the gaseous matter present in the comas and tails of sun-circling comets.

Unfortunately, one of the most important results of the recent eclipse observations has been the complete and final disproof of the solar character of the corona Mr. Huggins has succeeded in showing in photographs of the uneclipsed sun. We must confess that even the support of Professor Stokes—who is more cautious than Mr. Huggins himself—and of Captain Abney, whose photographic experience counted for much in such a matter, had not seemed to us to render Mr. Huggins's views about these photographed coronas probable, strongly though our wishes favoured the hope that he might be right, after all. Of course, it was not possible to reject Mr. Huggins's photographed corona as absolutely and unhesitatingly as we were forced to reject the fancy of Mr. Brett (the able landscape-painter) that he could actually *see* the corona without the aid of an eclipse! For Mr. Huggins's hopes were based on scientific possibility, viz. that the strongly actinic portion of the corona's light might make its pressure felt where the corona's light as it affects vision is demonstrably too weak to be discerned. Mr. Brett's fancy never had a trace even of possibility. The photographs of the partial eclipse at Cape Town and of phases preceding totality at the West Indian stations, unfortunately dispose finally of the idea that Mr. Huggins had photographed the real corona. For, under conditions far more favourable for showing the solar corona (because of the great diminution of atmospheric glare) the coronal appearances were much fainter, and—an even more decisive blow—no trace of the moon's form could be traced on such coronal streaks as appeared. Undoubtedly if the light around the sun in Mr. Huggins's photographs came really from the solar corona, the presence of the moon would have been clearly indicated in the pictures. The fact that the moon is not thus discernible proves that the coronal appendages seen round the sun belong to a region nearer than the moon—doubtless, therefore, to our own atmosphere.

Good photographs of the corona have been obtained by Captain Darwin and Mr. Schuster, some of them including photographs of the coronal spectrum. The corona's light has been measured by Professor Thorpe; but we do not learn how it was differentiated from the light of that portion of the air above the observer's horizon which was illuminated by full sunlight, even during mid-totality. It seems almost impossible to take duly into account the varying condition of our air in different eclipses, alike in regard to transparency (by which the corona's light is more fully received) and to light-reflecting power (by which more of the light falling on the air comes into play to diminish the darkness of total eclipse).

In reading the very voluminous report of the eclipse observations in the London *Times* a somewhat inexact idea might be conveyed by the circumstance that the results read as if they were due severally to Lockyer and Tacchini (persistently called Zacchini, such is fame!) to Darwin and Lockyer, to Lockyer and Perry, to Schuster and Lockyer, to Lockyer and Thorpe, to Maunder and Lockyer, to Lockyer, and so forth. This will be understood better perhaps when we note that the report is due solely to Mr. Lockyer's well-known reporting ingenuity; the eclipse itself he omitted to see, because at his station "it was not in sight." Only one new method is deemed worthy of special notice by the reporter, Mr. Lockyer's new photographic method, which must be far superior to all others, for he says so. It was bound to be a success. It *was* a success. "Mr. Lockyer," says Mr. Lockyer, "will not hear of want of success; he holds that the problem has been solved." Only one thing was wanting. "No photographs have been actually taken" by this method. Who, however, but a paltry caviller would mention such a mere detail as that? "In spite of the want of photographs . . . the problem has been solved"!

ETHNOLOGY OF THE BLACKFOOT TRIBES.

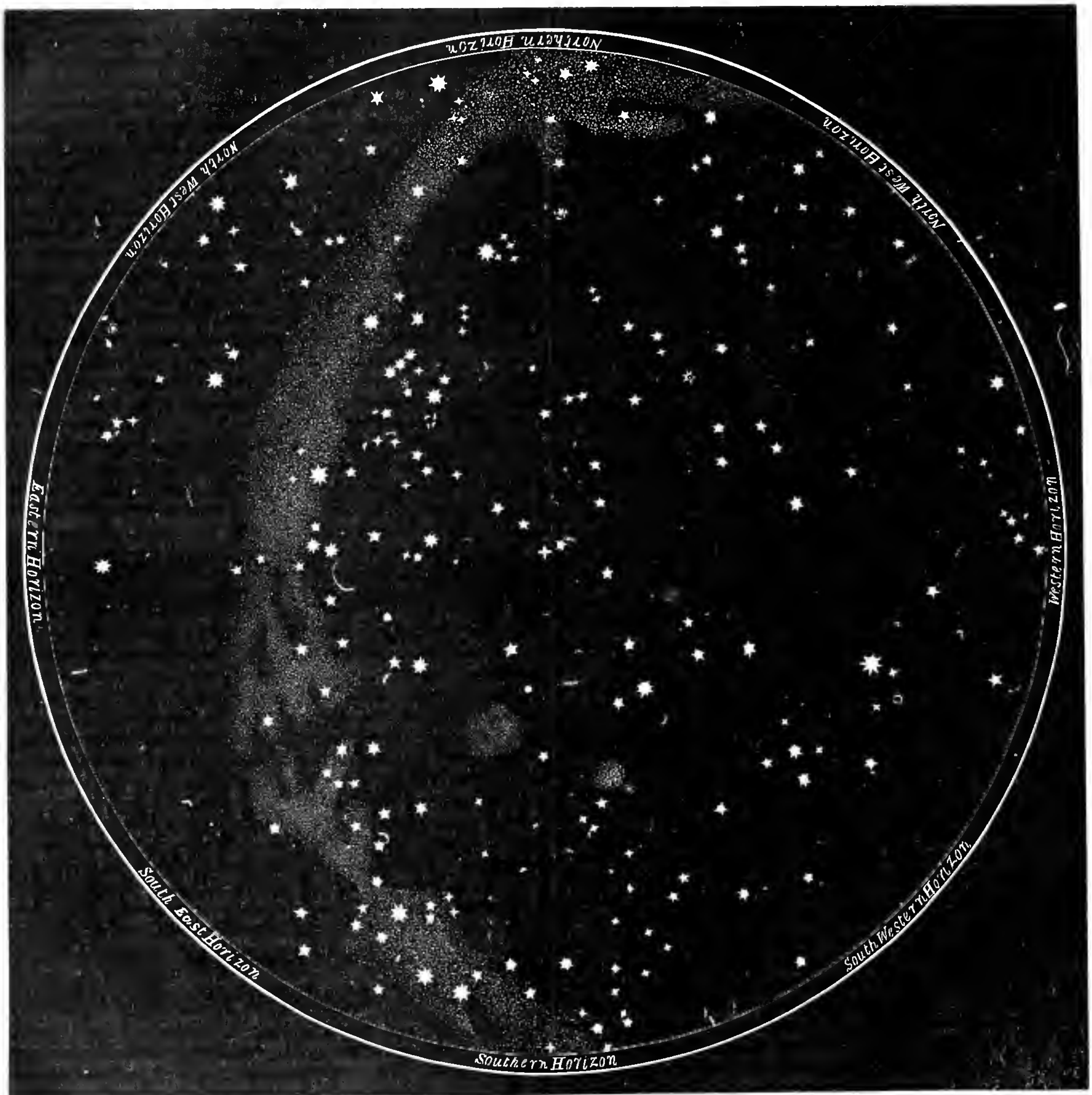
The primitive creation is attributed to a superior divinity, whom they call the Creator (*Apistotokin*), and sometimes identify with the sun. After this divinity—of whom their ideas are very vague—had created the watery expanse, another deity, with the aid of four animals, of which the musk-rat was the chief, brought some earth from the bottom of the abyss, expanded it to the present continent, and peopled it with human beings. This deity is commonly styled by them the "Old Man" (*Napiw*), a name implying, as used by them, a feeling of affectionate admiration. He is represented as a powerful but tricksy spirit, half Jupiter and half Mercury. "He appears," writes M. Lacombe, "in many other traditions and legendary accounts, in which he is associated with the various kinds of animals, speaking to them, making use of them, and especially cheating them, and playing every kind of trick." In this being we recognise at once the most genuine and characteristic of all the Algonkin divinities. In every tribe of this wide-spread family, from Nova Scotia to Virginia, and from the Delaware to the Rocky Mountains, he reappears under various names—Manabozho, Michabo, Wetuks, Glooskap, Wisaketjak, Napiw—but everywhere with the same traits and the same history. He is at once a creator, a defender, a teacher, and at the same time a conqueror, a robber, and a deceiver. But the robbery and deceit, it would seem, are usually for some good purpose. He preserves mankind from their enemies, and uses the arts of these enemies to circumvent and destroy them. In Longfellow's charming poem, he is confounded with the Iroquois hero, Hiawatha. In Dr. Brinton's view, his origin is to be found in a Nature-myth, representing "on the one hand the unceasing struggle of day with night, light with darkness, and on the other that no less important conflict which is ever waging between the storm and sunshine, the winter and summer, the rain and clear sky."

A California Tree.—There was recently felled in Lonoma County, California, a tree which cut up as follows. The *Petaluma Argus* says that the details can be relied upon. The standing height of the tree was 347 ft., and its diameter near the ground was 14 ft. In falling, the top was broken off nearly 200 ft. distant from the stump, and up to the point of breaking the tree was perfectly sound. From the tree saw-logs were cut of the following lengths and diameters:—1. 14 ft. long, 9 ft. dia.; 2. 12 ft. long, 8 ft. dia.; 3. 12 ft. long, 7 ft. 7 in. dia.; 4. 14 ft. long, 7 ft. 6 in. dia.; 5. 16 ft. long, 7 ft. dia.; 6. 16 ft. long, 6 ft. 10 in. dia.; 7. 16 ft. long, 6 ft. 6 in. dia.; 8. 16 ft. long, 6 ft. 4 in. dia.; 9. 16 ft. long, 6 ft. 3 in. dia.; 10. 18 ft. long, 6 ft. dia.; 11. 12 ft. long, 5 ft. 10 in. dia.; 12. 18 ft. long, 5 ft. 6 in. dia. It will thus be seen that 180 ft. of this remarkable tree were converted into saw-logs.

With reference to the obvious idea pervading Mr. Proctor's articles on "Americanisms" in the last number of Knowledge that the critique in the *Saturday Review* was written by me, may I venture to state that I did not write that paper, that I have not contributed to the *Saturday* for years, that I do not know who was the author, that I supplied no facts or material for it, and that I was ignorant of its very existence till I saw myself accused of having composed it? I have written a full denial of the imputation to Mr. Proctor, and I earnestly trust the misapprehension may not impair a friendship which I value, and have always valued, very highly.—Grant Allen.

THE SOUTHERN NIGHT SKIES.

IN the last volume of KNOWLEDGE I began a series of maps of the night skies of the southern hemisphere, intended to show them for each night in the year all the year round. But a series of blunders and delays on the part of the engravers, and the most contradictory misinterpretation of my instructions, prevented me from carrying out my design. Only three maps of the duplicate. One map will show the stars down to the third magnitude, with a few of the smaller stars when necessary to complete groups, on a black ground without any names or lettering. The other will show the same stars on a white ground, with the names of constellations, Greek lettering for stars, and other writing and lines for guidance. Each paper of the series will appear two months in advance, so as to be in good time for readers in Australasia and Cape Colony. In the first pair, accompanying this, the night



MAP 1*a*. NIGHT SKIES OF AUSTRALASIA, CAPE COLONY, &C., FOR JANUARY.

series appeared, and those so late as to be scarcely of any use for the purpose intended.

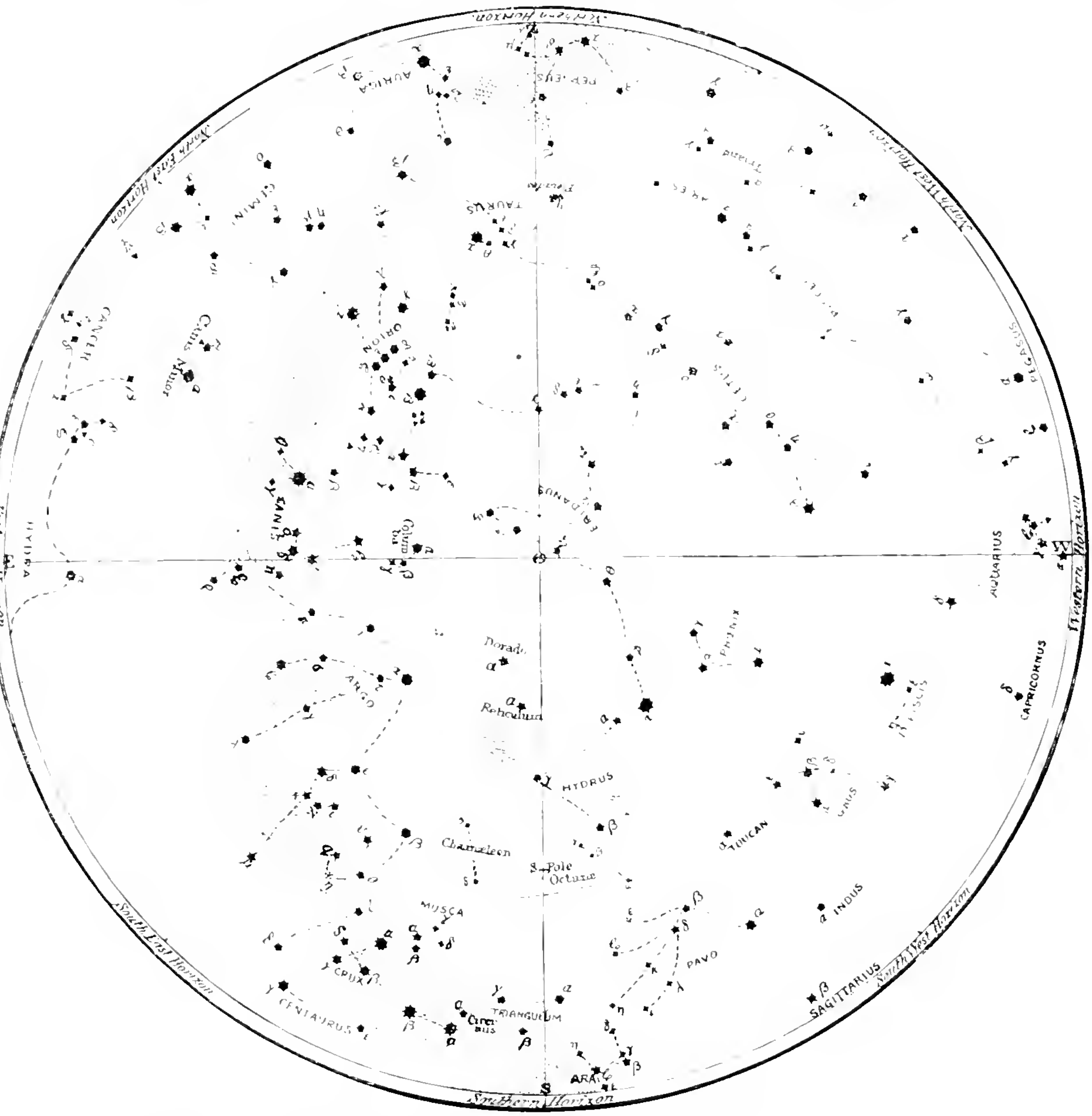
I now begin the series afresh under more favourable conditions. I propose to present the skies of the southern hemisphere now, for latitude 38° south, or accurately enough for such maps, for all places between latitudes 30° and 45° south, in skies for January are presented. The maps are for the following hours:—

At 10 o'clock, December 23.
,, 9¾ o'clock, December 26.
,, 9½ o'clock, December 30.
,, 9¼ o'clock, January 3.
,, 9 o'clock, January 7.
At 8¾ o'clock, January 10.
,, 8½ o'clock, January 14.
,, 8¼ o'clock, January 18.
,, 8 o'clock, January 22.

To the traveller voyaging southwards the skies which in England lie towards the south at these hours rise higher and higher, till at length those which had been along the horizon from east through south to west lie on a circle passing overhead from east through the zenith to west. The southern half of our English night skies at any hour is the northern half of the skies of latitude 38° south at the same hour, but while our southern horizon stars make an arch overhead with them, their northern horizon stars make an arch overhead with us.

Thus the series of maps which is now commenced will serve, as a moment's study will show, to present our English southern skies (in the upper half of each map) for every night of every month in the year, the horizontal central line of the map representing the horizon for this use of the maps, while it will show the whole of the sky for the southern hemisphere, the circumference of the map representing the horizon. Turning to the south we find no polar star. (Mr. Hampden says that there is no pole, but mistakes.) The nearest star to the pole in our map is *κ Octantis,* a fifth-magnitude star. Below the pole we see the Triangle (Southern) with *Pavo* (the Peacock) on the right or west, *Musca* (the Fly) and *Crux* (the Cross). These constellations with the pole, *Chamæleon*, the *Reticulum* (the Net), *Hydrus* (the Water-Snake), and *Toucan* (the Toucan), are always visible in the southern region named, being circumpolar. Other south polar constellations are not shown, having no stars higher than the fifth magnitude.

High up in the south-east we see the great ship *Argo*, wrong side up with care. Naturally the sea-serpent *Hydra* is flourishing her mighty length along the horizon underneath the masts and sails of the ship.



MAP 1*b*.—KEY TO MAP 1*a*. NIGHT SKIES OF SOUTHERN HEMISPHERE FOR JANUARY.

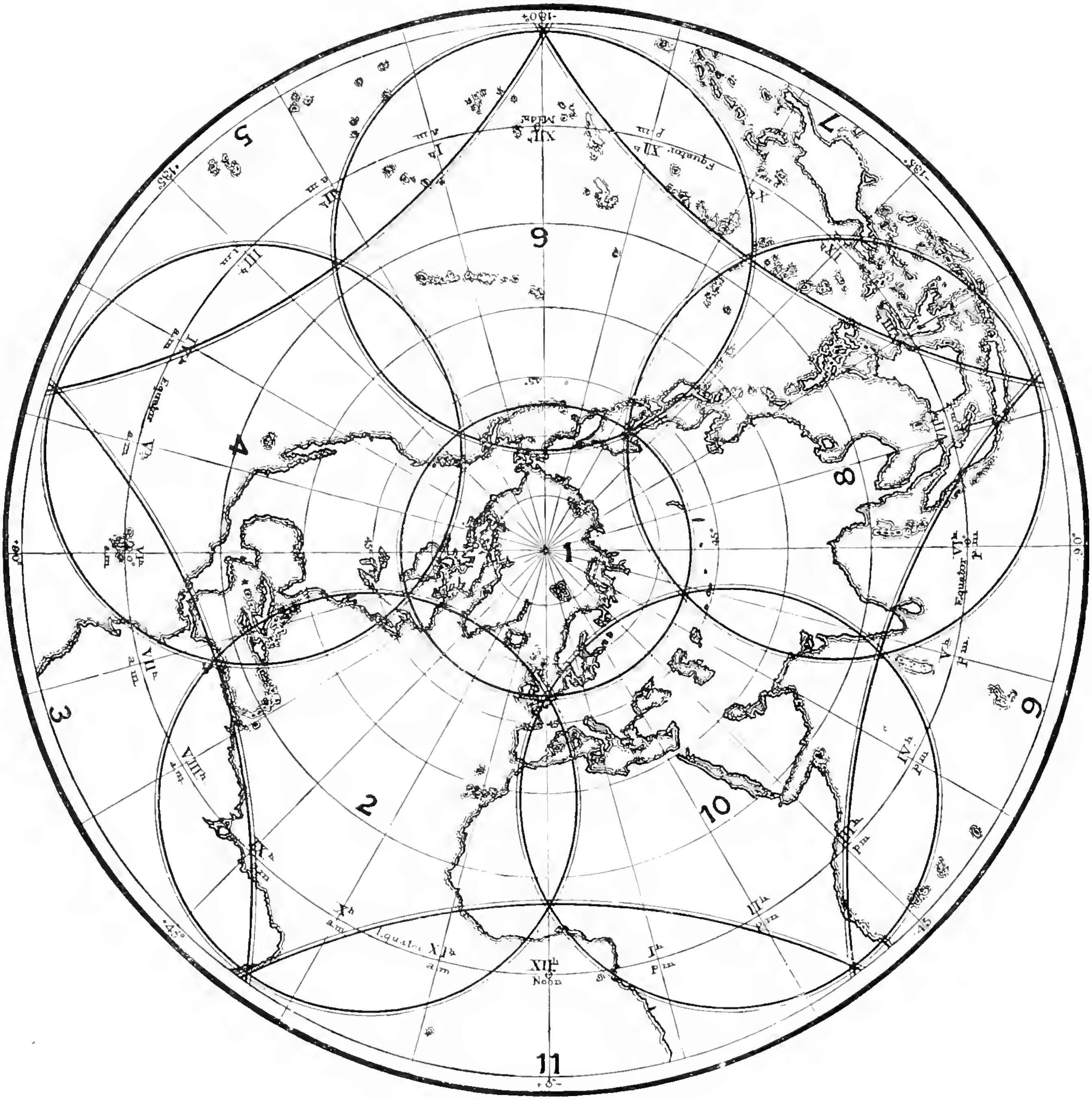
Due east is *Canis*, the Greater Dog, high up, and on his back; the Dove, *Columba*, being perched on the Dog's hind feet.

In the north-east we see *Orion* on his head, but he makes nearly as fine a figure if his shoulder stars for our hemisphere are made leg stars for the Southern, and *vice versâ*. *Gemini*, the Twins, stand also on their heads, and by no means suggest the idea of twins.

Taurus is the chief constellation towards the north at this time, just as from our hemisphere he is the chief constellation towards the south. Of course, it will be understood that the movement of Orion, Taurus, and all these other constellations in the northern skies of the southern hemisphere, is from east to west, or from right to left.

Overhead, the winding streams of the river *Eridanus* extend from near β of Orion to between *Phœnix* and *Hydrus*, where the bright *Achernar* (α Eridani) is seen—a star now too far south to be seen from those places in the northern hemisphere, where it used to be seen in the time when it received its name.

In the south-west quarter of the sky we see the Northern Triangle, *Aries* (the Ram), *Pisces* (the Fishes), *Cetus*, the Sea Monster, and *Aquarius*, the Water Bearer.



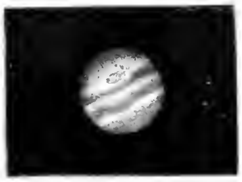
North Polar Index Map.

A UNIFORM ATLAS.

We give this month the north polar index map for the proposed uniform atlas; the southern index map will be given next month, to which occasion (space pressing very much this month) we reserve the explanation of the plan by which we propose to present the whole surface of the globe in twelve equal maps, in which the different parts of the earth will be presented in the same uniform plan and on the same uniform scale throughout.

PHOTOGRAPH OF JUPITER.

THE accompanying photograph of Jupiter, by the Brothers Henry, is full of promise. It was taken on April 21, 1886, and is interesting because of the presence of the great red spot first detected by Professor Pritchett, of Glasgow, Missouri, in 1877, and since carefully and continuously observed by many students of astronomy. MM. Henry remarks that the red spot is more striking



and better defined (*plus nette*) in the photograph than by direct telescopic vision.

OUR PUZZLES.

SOLUTIONS of the three puzzles VII., VIII., and IX. are given under the heading "Mathematical Recreations." I have received other solutions of Problems I. and II. besides those given (one for each puzzle) in KNOWLEDGE for September.

Puzzle I. Nineteen trees may be arranged so as to make nine rows of five trees in the following ways, the first of which is that given as the solution :—

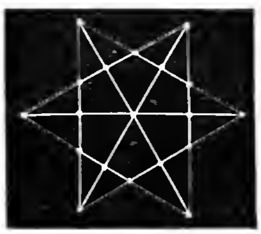


FIG. 1.

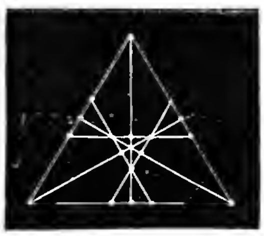


FIG.

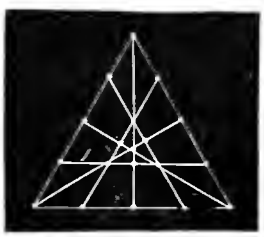


FIG. 3.

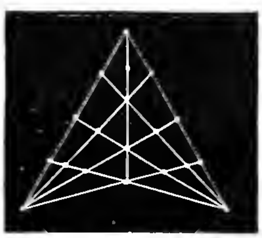


FIG. 4.

These solutions all possess a certain degree of symmetry, and all certainly fulfil the conditions of the puzzle as it reached my hands. I might easily modify the conditions of the problem so that the solution in fig. 1 should be the only one available. For instance, that is the only solution in which the five trees on each row are so arranged that the middle tree is at the centre of its row, and the other four form equidistant pairs on either side of it. But instead of hampering the problem with conditions of detail spoiling it as a puzzle, I will take a bolder course, and replace it with a puzzle of my own invention, and of greater difficulty, thus :—

PUZZLE X. *Arrange nineteen trees so as to make* TEN *rows of five trees in each row.*

Again, six cords may be stretched between nine pegs, or a smaller number, so as to enclose ten spaces in any of the following ways, the first of which is that I gave as a solution :—

FIG. 5.

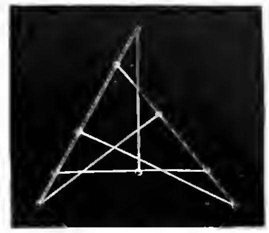


FIG. 6.

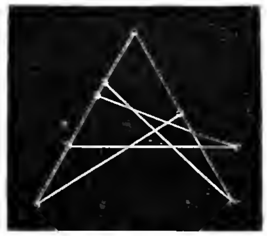


FIG. 7.

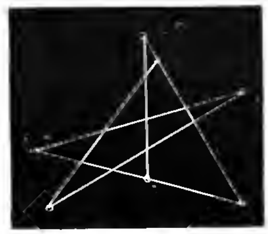


FIG. 8.

Here only fig. 5 is symmetrical, and that only in an axial, not in a central manner. Observe the following distinctions between these four solutions :—

In fig. 5 there are 4 triangles and 6 quadrangles : 9 pegs.

In fig. 6 there are 6 triangles, 2 quadrangles, 2 pentagons : 9 pegs.

In fig. 7 there are 7 triangles, 3 pentagons : 8 pegs.

In fig. 8 there are 6 triangles, 3 quadrangles, 1 pentagon : 7 pegs.

Not one of these arrangements seems to me quite as good as it might be; the arrangements in figs. 6, 7, 8 are altogether unsymmetrical, and that in fig. 5 has only partial symmetry; while there are too many different shapes in all the arrangements. I therefore present in this case also a new puzzle on the same lines, and almost the same cords and pegs—a neater puzzle of somewhat greater difficulty (though the completeness of the conditions really indicates the direction in which a solution is to be found); thus—

PUZZLE XI. *With six cords, fastened to nine pegs, enclose ten spaces of the following forms :—*

First, one equilateral hexagon having equal alternate angles ;

Secondly, three equal and similar quadrangles, each axially symmetrical ; *

Thirdly, six equal and similar triangles.

As a third problem, which for symmetry's sake shall be closely related to our third puzzle, even as these two are closely related to the first and second, I repeat here a puzzle which was given and very fully solved in the early numbers of KNOWLEDGE by the ingenious "Mogul" :—

PUZZLE XII. *Given a rectangular carpet of any shape and size to divide it with the fewest possible cuts so as to fit a rectangular floor of equal size but of any shape.*

* A figure is said to be axially symmetrical when a straight line can be drawn as an axis dividing it into two equal and similar portions, such that if either were rotated about said axis through two right angles it would exactly coincide with the other. Thus an isosceles triangle is axially symmetrical, the bisector of the angle between the equal sides being its axial line.

MATHEMATICAL RECREATIONS.

THE interest taken in the quasi-mathematical puzzles which have recently appeared in KNOWLEDGE has suggested the idea that pleasant recreation might be combined with useful instruction in the properties of mathematical curves, figures, and so forth, in a series of papers (not necessarily continuous), to be called Mathematical Recreations.

As examples, I take the three puzzles given in the October number of KNOWLEDGE.

I. THE PARABOLA.—The properties of this curve must of course be studied in treatises on conic sections to be thoroughly understood; but many who do not care to enter into such complete study of the curve as this may be interested to know how they may pleasantly and prettily construct true parabolas, while others who really are students of mathematics will gain clearness of insight into the parabola's properties by constructing the curve in various attractive yet exact ways.

Of all recreative ways of presenting geometrical curves none are so pleasing, either in actual construction or in their effect, as those which show a series of enveloping tangents, as is required in the puzzle on the parabola. I give for the present only methods of this kind. (The curves

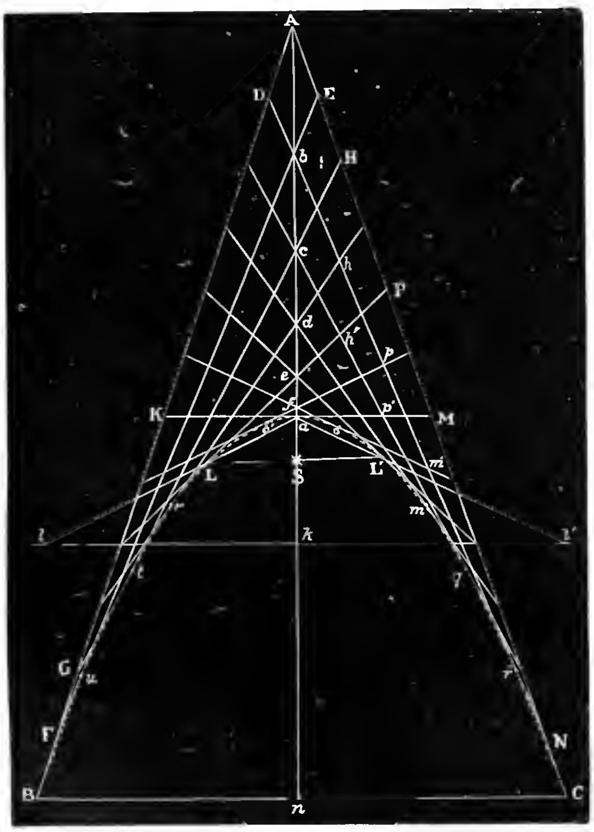


FIG. 1

may be dealt with in other ways, some of which are perhaps in a geometrical sense more effective.) All the conic sections may be represented by enveloping tangents, but the construction for the parabola is the simplest of all.

Draw lightly in pencil on a card, preferably an enamelled white or tinted card—only in this case draw the lines on the unenamelled sides—two straight lines, AB and AC, fig. 1, at some such angle as is shown in the figure. Opening a pair of dividers to any convenient small distance, AD or AE, measure off equal distances along AB and CA as shown. There is no occasion to divide a given line, AB, into a number of equal small parts; simply the measurements go on from A till a point is reached conveniently near B, and then similar measurements are made along AC. There should be the same number of divisions along AB and AC, and the number should be even, for a reason presently recognised. Now pierce fine holes through the card at the division marks, and taking a needleful of fine silk (of any dark colour if the card is white, but if the card has tint then it is best to have the silk of the complementary colour) carry it from B (where it may be knotted on the under side) to A, thence under the card to come out at E and from E to F, thence under the card to G, and from G to H, and so on. If the number of divisions was originally even, you arrive in this way at a line KM, and going on, you finish with the lines DN and CA, completing the series of thwart lines. Each of these lines is a tangent to a parabola having its axis on the bisector of the angle BAC, and the lines drawn as described show the true shape of a parabola very effectively by giving a series of enveloping tangents. You may now draw BC and bisect in n, connecting An with a line of silk. This line bisects KM as at a, which is the vertex of your silken parabola. If your work has been correctly done, all the corresponding tangent lines from AB and AC cross on An.

To mark in the focus of your parabola, the construction indicated in the figure is all that is necessary. Draw any straight line, as lkl', parallel to KM or BC, and take kl and kl', each equal to twice ak. Then drawing la, $l'a$, you have lines intersecting the parabola at the extremities of the *latus rectum*, LSL', cutting an in the focus S. These lines of construction should be drawn in pencil, lightly, before the parabola is obtained from its silken envelopes. Afterwards pierce the card at L and L', and take a silken line LSL'. Around the focus S a little star may be made (with yellow rays) as shown in the figure.

The following features may be noticed:—

(1) Such intersection points as H, h, h', &c., Ppp', &c., lie on lines parallel to An. By an optical illusion, it will be found that if we run the eye from any division point (as H) on AB AC to the series (as h, h', &c.) really lying on a line parallel to An, the idea is conveyed that the line so followed curves inwards towards An.

(2) If we take points P, h, c, &c., or M, p, h', d, &c., running from any division point along AC or AB athwart the other diagonals of the quadrangular divisions, we get a series of points lying on a parabola having its axis in the line An.

(3) The alternate parallels thus obtained are diameters through o, o', L, L', &c., the points in which the enveloping tangents of our figure touch the parabola.

(4) If we take any point, as o, in which one of the tangents touches the parabola, then a series of lines, aL', $o'm$, Lq, rr', &c., obtained by joining the successive points of tangential contact on either side of o, will be parallel to each other and to the tangent at o; so that they will be ordinates to the diameter through o.

II. THE ELLIPSE.—This, of all the conic sections, is the least convenient to deal with in the manner we are considering. Here, however, is a construction, the reason and demonstration of which I leave the student to deduce for himself:—

Let CA, CB be the half axes of the ellipse we want to draw. Complete the rectangle CBDA, and the quadrant FDE. Divide BF and AE at G, H, K, L, &c., and P, Q, R, &c., so that the spaces between the divisions rapidly diminish as shown (no special construction is necessary). Then proceed as follows: Opening a pair of dividers to span CG, keeping the end of one leg at C, mark the point *g* on BD with the other; then opening to span B*g*, and setting the end of one leg at G, mark the point *g*′ on CB with the other; do the like, starting with the span CH, getting the point *h*′; and so get a series of division marks *g*′, *h*′, *k*′, *l*′, *m*′, *n*′, and *o*′ on CB; dividing AD similarly at G′ (such that DG′=B*g*′), H′, K′, &c. Again, opening a compass to span CP, mark the point *p* on AD, having end of one compass-leg at C, and with span A*p* measure off P*p*′; do the like, starting from the span CQ, getting the point *q*′; and so get a series of division marks *p*′, *q*,′ *r*′, *s*′, and *t*′ on CA, dividing BD similarly at P′ (such that DP′=A*p*′), Q′, R′, S′, and T′.

Now join FE, GG′, HH′, KK′, LL′, &c., PP′, QQ′, RR′, &c. The lines thus drawn will envelop tangentially a quadrant of an ellipse having CB and CA as semi-axes.

If, having carefully made this construction in pencil, we prick off corresponding division marks on the two diameters

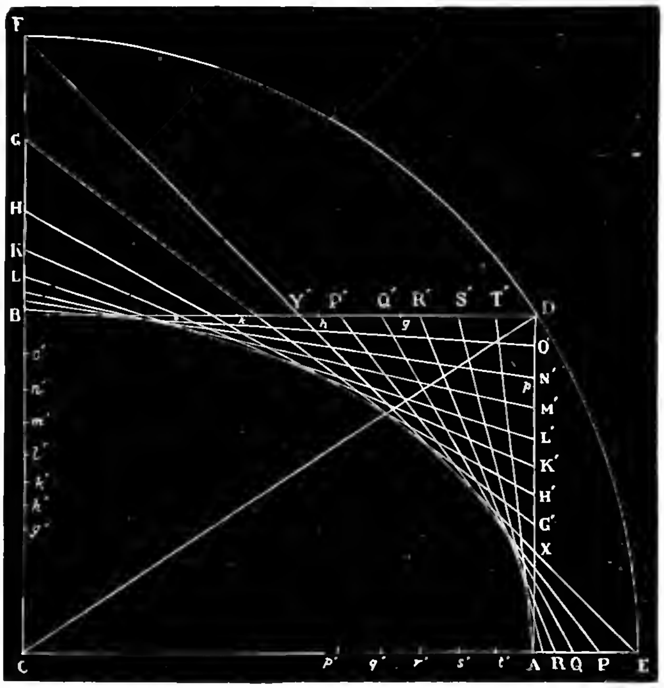


Fig. 2.

of which CE and CF are the halves, and on the four sides of the inclosing rectangle (BD and DA being halves of two of these sides), prick off division marks corresponding to those on DY, DX (YDX is half a square), we obtain the tangential envelopes of the complete ellipse. The resulting figure has a somewhat singular appearance, the ellipse seeming strangely cut out from within the inclosing circle of which FDE is a fourth.

The same figure may be formed, more quickly, by making two direct tracings of fig. 2, and two inverted tracings (these can be made by turning the figure with its face towards a glass sheet, and tracing from behind by means of the light received through the glass), and combining these four figures into one.

III. The Hyperbola.—There are several ways of obtaining an hyperbola by means of a series of enveloping tangents. Hereafter I shall introduce a prettier and more symmetrical method than that which I present here: but this will serve as a convenient companion to the methods used for the other conic sections.

Let C be the centre, CA a semi-axis, and CD, CD′ the asymptotes of the proposed hyperbola. Along DC take the points E, F, G, nearing each other towards C. Let parallels (not drawn in the figure) through D to D′E, D′F, and D′G cut

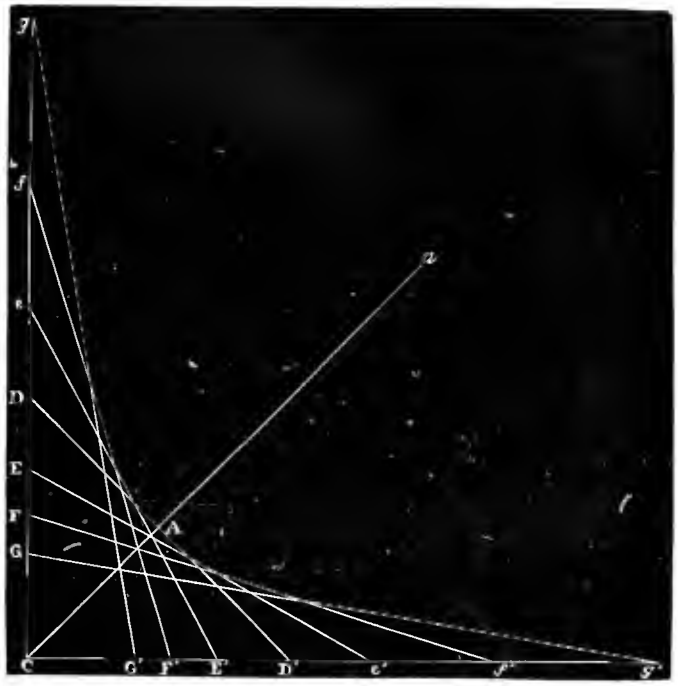


Fig. 3.

CD′ produced in *e*′, *f*′, *g*′; and make the divisions along C*g* and C*g*′ alike, in the points *e*, *f*, and *g*, G′ F′, and E′. Then join by straight lines *g*G′, *f*F′, *e*E′, DD′, E*e*′, F*f*′, and G*g*′. These lines will envelop the required hyperbola—that half which lies within the space *g*C*g*′. The other half can be similarly obtained.

THE SCHOOLGIRLS' PUZZLE.

THE problem of arranging fifteen schoolgirls so that they may walk out in sets of three, seven days in succession, no two girls being in the same set of three twice, has been rather fully dealt with in Vol. I. (No. 9), Vol. II. (No. 35), and Vol. III. (Nos. 73 and 79—twenty-one schoolgirls to walk ten days in sets of three). The general discussion cannot, I find, be presented in a manner suited to these columns, as considerations of some complexity presently arise. But the following points may be noted in regard to problems of this class.

First, take such a problem as the pairing of an even number of chess-players as in tournaments, where each player is to meet one opponent each day till he has met all, the encounters on each day all beginning at the same time. Or, if we must have schoolgirls in the puzzle, let an even number of schoolgirls have to walk in pairs, day after day, each having a different partner on each day until she has walked with all the rest.

This puzzle or problem can always be very easily solved as follows.

Calling the several girls A, B, C, D, &c., write down all the combinations of the set, in pairs, in order thus :—

AB, AC, AD, AE, AF, &c.
BC, BD, BE, BF, &c.
CD, CE, CF, &c.
DE, DF, &c.
EF, &c.
&c.

Then repeating the first row, write under it in succession such of the pairs of the second, third, fourth, &c., rows in succession as can walk with the pairs in the first row. Do the like with the pairs in the third and other rows, always putting in the next available pair on a row in the first available place, and filling up according to the requirements for each day's walk, that is, so that every girl may go out each day. The result is bound to come out right.

Thus, suppose there are eight girls, A, B, C, D, E, F, G, H, then the lists come out as follows :—

1st day.	2nd day.	3rd day.	4th day.	5th day.	6th day.	7th day.
AB	AC	AD	AE	AF	AG	AH
CD	BD	BE	BF	BG	BH	BC
EG	EH	CF	CG	CH	CE	DG
FH	FG	GH	DH	DE	DF	EF

But although this method always solves the problem satisfactorily, there is a more systematic plan worth knowing. It was given by Mephisto in Vol. III. of Knowledge (No. 71). The solution for the case we have just been dealing with is shown in the following figure :—

	A	B	C	D	E	F	G	H
A	—	1	2	3	4	5	6	7
B	1	—	3	4	5	6	7	2
C	2	3	—	5	6	7	1	4
D	3	4	5	—	7	1	2	6
E	4	5	6	7	—	2	3	1
F	5	6	7	1	2	—	4	3
G	6	7	1	2	3	4	—	5
H	7	2	4	6	1	3	5	—

Here the letters represent the eight girls, the seven days on which they are to walk are indicated by the numbers, and a number on any row and column signifies that on the day bearing that number the two persons represented by the two letters marking that row and that column are to walk together. Thus those squares running diagonally across the figure which mark severally a row and a column belonging to the same person remain, of course, unnumbered. The numbers on the first row and column are 1, 2, 3, 4, 5, 6, and 7, showing that A is to walk on the seven successive days with B, C, D, E, F, G, and H. Next, according to Mephisto's way of presenting the method, write in along the second row and column the numbers in order from 1 (at the left and top respectively), omitting the square which is to be left vacant, and setting the number 2, which would have fallen on that square, on the last row and the right-hand column respectively. We do the same with the third row and column, setting the omitted figure, 4, over to the bottom and to the right; and so on to the end. We thus complete a schedule, which would arrange the girls as follows :—

1st day.	2nd day.	3rd day.	4th day.	5th day.	6th day.	7th day.
AB	AC	AD	AE	AF	AG	AH
CG	BH	BC	BD	BE	BF	BG
DF	DG	EG	CH	CD	CE	CF
EH	EF	FH	FG	GH	DH	DE

The *rationale* of this method is obvious. Omitting the H row and the H column, and supposing the vacant squares occupied by the numbers left out in the actual solution, we see that the successive rows may be supposed to be obtained by shifting the preceding row one square to the left and carrying the square thrust out in this way on the left over to the right. This, of course, ensures that every number will fall in succession opposite each letter both on row and on column, so that, applying the result, each person of the set, whether of schoolgirls or of chess-players, will be paired against every other in succession. The same result may be obtained more conveniently, however, as follows :—

A	1						
B	2	3					
C	3	4	5				
D	4	5	6	7			
E	5	6	7	1	2		
F	6	7	1	2	3	4	
G	7	1	2	3	4	5	6
	A	B	C	D	E	F	G

Here we have only seven letters, but interpreting the numbers as in the other method, we see that on certain days we get AA, BB, CC, &c. Introducing in each case an eighth letter H, for the second member of these doubles, and taking the columns in order from left to right, we get the following arrangement :—

1st day.	2nd day.	3rd day.	4th day.	5th day.	6th day.	7th day.
AH	AB	AC	AD	AE	AF	AG
BG	CG	BH	BC	BD	BE	BF
CF	DF	DG	EG	CH	CD	CE
DE	EH	EF	FH	FG	GH	DH

the same arrangement as before. This plan is not only easier and simpler, but it serves better, I think, to indicate the principle on which the method depends. We see that each number representing a day *must* come in four times, and must get a different pair of letters for each time it appears. Take, for example, the 6th day, and begin with the 6 in the first column, which gives us the pair AF; the next 6 being one to the right and one above takes the pair BE; the next takes the pair CD; and we see that the remaining 6 corresponds to GG, and so gives the pair GH. We can also see why the number which in the other way of working this method would fall on the square to be left vacant is carried over to column and row belonging to the eighth letter.

My plan is also convenient because the same figures may be used for all cases. Suppose the first seven lines above only shown, and that the first column is continued by running on the letters in order, the other columns by running on the numerals, fresh columns being added at the right, then by setting a strip bearing the letters A, B, C, &c., as in the lowest row of the figure above, at whatever distance from the top the number of schoolgirls or chess-players may require, we have at once the solution for that number.

The number of letters in this method will be odd, and the letter afterwards added making the total number even. Obviously, if the total number is $2n$, there will be n pairs each day, and $(2n-1)$ days of different arrangements.

With regard next to the fifteen schoolgirls. In the numbers above referred to several methods are given for dealing with problems of the kind, where the division is into sets of three. But the 15 may be dealt with thus:—

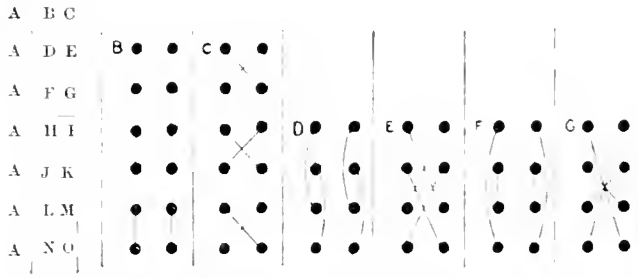
We require all the 15 to go out, each day, in threes, for seven days. There will thus be 35 sets of three, no two of one set being found in any other. If we can find such 35 sets, we shall have solved the problem, for it will then be easy to take these sets five and five, each five containing all the 15 girls. This being so, we might solve the problem by a hammer-and-tongs method—writing down all the 455 combinations, and then selecting 35 fulfilling the condition indicated, and arranging these as required. Thus our sets of combinations and our work of sifting out would begin like this—

Combinations.	Number.	No. Taken.
ABC, ABD, ABE, ...ABO	13	ABC
ACD, ACE, ...ACO	12	none
ADE, ...ADO	11	ADE
....	...	...
AMN, AMO	2	none
ANO	1	ANO
	91	7
BCD, BCE, BCF, BCG ....BCO	12	none
BDE, BDF, BDG ....BDO	11	BDE
BEF, BEG .... BEO	10	BEG
BFG ....BFO	9	none
....	...	...
BMN, BMO	2	BMO
BNO	1	none
	78	6
CDE, CDF, CDG, CDH ....CDO	11	CDG
CEF, CEG, CEH ....CEO	10	CEF
CFG, CFH ....CFO	9	none
CGH ....CGO	...	none
....	...	...
CMN, CMO	2	CMN
CNO	1	none
	66	6
DEF, DEG..... ...DEL, DEM..... DEO	10	none
DFG........ DFL, DFM......DFO	9	none
....	...	...
.........DHL, DHM......DHO	7	DHL
......DIL, DIM ......DIO	6	DIM
......DJL, DJM ......DJO	5	DJN
......DKL, DKM .... DKO	4	DKO
....	...	...
.... DNO	1	none
	55	4

And so on to the end. (I have given the D combinations more fully than the others, to show how as the end draws near the combinations available have to be sought further along the rows.) Proceeding in this way we get the following 35 combinations:—

ABC						
ADE	BDF	CDG				
AFG	BEG	CEF				
AHI	BHJ	CHK	DHL	EHM	FHN	GHO
AJK	BIK	CIJ	DIM	EIL	FIO	GIN
ALM	BLN	CLO	DJN	LJO	FJL	GJM
ANO	BMO	CMN	DKO	EKN	FKM	GKL

These thirty-five combinations can be obtained more conveniently, however, by a method which was suggested in Knowledge, Vol. I. (No. 9). (I fear the volume is out of print.) The following is a simplified explanation. The plan depends on putting down first all the available combinations beginning with A, viz., ABC, ADE, AFG, AHI, AJK, ALM, ANO: then taking the fourteen letters without A, and out of them making all the available combinations beginning with B and C, six of each; then those beginning with D, E, F, and G, four of each. The best way of doing this is illustrated in the following figure, where the dots stand for the letters similarly situated in the A column:—



This gives the same arrangement as before. (The arrangement should be compared with the above figure, when any difficulty as to the interpretation of the dots will be at once removed.)

If we now make sets of fifteen out of these combinations of three, we do not at once get the arrangement required; but each trial requires only a few minutes, and there are not more than three or four cases to be dealt with. We presently obtain the following arrangement:—

1st day.	2nd day.	3rd day.	4th day.	5th day.	6th day.	7th day.
ABC	ADE	AFG	AHI	AJK	ALM	ANO
DIM	BLN	BMO	BEG	BDF	BHJ	BIK
EJO	CHK	CIJ	CLO	CMN	CEF	CDG
FHN	FIO	DHL	DJN	GHO	GIN	EHM
GKL	GJM	EKN	FKM	EIL	DKO	FJL

In like manner other cases can be dealt with where sets of three are in question. The numbers of Knowledge above mentioned contain general rules and methods for such cases.

The problem relating to the sixteen whist-players, who are to sit down at four tables on five successive evenings, so that no two shall play twice in the same set of four, was of my own invention. When I set it I had not solved it, but I knew on general principles that it must admit of being solved. It has proved a trifle tougher than I expected, but is not very difficult. I defer the solution for a month, because I find that it depends on another problem relating to sets of three, which may be thus presented:—

Problem.—*How may twelve schoolgirls go out three and three on four days, and then four and four on a fifth day (or twelve whist-players play single dummy four days and the full game on a fifth day, each day retaining their places unchanged throughout), in such a way that no two will twice belong to the same set whether triplet or quadruplet?*

The solution of this problem, as well as that of the problem of sixteen whist-players, will be given next month.

NOTES ON AMERICANISMS.

By Richard A. Proctor.

THE amazingly and amusingly false assertions in the *Saturday Review* about my "Notes on Americanisms," and especially the statement (wittingly untrue, I fear) that I was writing on a subject, in this case, which I had not studied, were, of course, corrected, for all who know anything about America, by the blundering sequel, in which the critic mistook at least four of every five phrases which he undertook to explain. But it occurred to me at the time that I might present evidence from my note-books of travel to show that American talk had received more than a mere passing attention from me during my widely ranging travels through the United States and Canada. On referring to my notes, however, I found that they were scarcely suited for such use, as the talk quoted ran for the most part into mere scraps—useful enough in forming a glossary, but not worth separate quotation.

One case, however, seemed an exception. I found a fairly connected conversation recorded (the morning after it was heard) which not only illustrates one class of American talk among the uncultured, but also a peculiarity of American manners—viz. the freedom with which in America the ubiquitous "lout" is allowed to annoy and interrupt persons who are unfortunate enough to be near him. In places like the theatre, the concert-room, and the lecture-hall a noisy or ill-mannered neighbour is objectionable even to a man who cares nothing for class distinctions. In America one can never be quite sure that, instead of the play or music or lecture one has paid for, one may not have to endure the foolish chatter or the offensive manners of some boor who has apparently come in for no other purpose but to annoy his neighbours. In the old country, I know, such a boor may find admission among respectable persons; but if he will not behave properly he will quickly be shown the way out. It is otherwise in America. Freedom seems to include the right to annoy every one within sight and hearing, just as much as any boors present may see fit. At least, I have often seen a company enduring the misconduct of such folk with only muttered complaints; and I have never seen even the most offensive person turned out.

Occasionally an experience of this kind has its amusing aspect. Instead of a play one may have a farce, which, though not precisely what one has come to hear, may be almost as entertaining.

I was amused, for instance, in this way, for a while at least, one evening in 1880 at Haverley's Theatre, Chicago, where I had gone to hear Paola Marié in the part of Serpolette. Two men sat behind me, who could scarcely have come to hear the "Cloches de Corneville," as neither of them understood a word of French or listened to a note of the music. They were accompanied by a quiet-looking Frenchwoman, of middle age, who had probably come there expecting a pleasant evening in listening to her clever countrywoman on the stage. If that was her hope, I fear she was disappointed. Her companions, of whom she seemed heartily ashamed, talked rambling nonsense nearly the whole time—nonsense dreary enough in the recital, though it amused me at the time, even in the midst of my annoyance at the loss of Mezières' good acting and Paola Marié's good acting and singing.

Here is the record of their conversation, as made at the time. It is not quite continuous, for occasionally they went out ("to see a man," as they explained to their companion), and sometimes I was able for awhile to fix my attention wholly on the stage, even while they talked. For convenience I call them P. I. and W. I.—for Partly Inebriate and Wholly Inebriate:—

P. I. "Them gals in tights is having a deal of chin-play."

W. I. "What in Hades" (he was more monosyllabic) "is it all about, any way? (*A pause.*) That little one ain't got no manners—not to *say* manners—she ain't."

P. I. "You bet she ain't."

W. I. "She's another fraud. Why in h— don't they get one that can act like a lady *should*?" (Paola Marié was impersonating Serpolette charmingly while thus appreciatively criticised.)

Exeunt P. I. and W. I. to "see a man," as they explained to the lady. It is customary now to say that the man is "the person who dispenses cloves"; but if my two philosophic friends had called on such a man, his cloves must have been of inferior quality, for the smell of whisky which diffused itself around them was not perceptibly tempered by any foreign aroma. They had become more solemn than before. In fact the amusement they gave me resided as much, I suspect, in the melancholy gravity of their demeanour and the solemnity of their nasal tones, as in what they actually said:—

W. I. (*Apparently continuing a philosophic discussion.*) "A man only knows what he learns. . . . Yes, *sir*. . . . YES! . . . a man has to learn if he wants to know."

P. I. (*As one suddenly enlightened.*) "Thet's *so*."

W. I. "Yes, *sir*. You may bet your bottom dollar on that. . . . It's *so* (*a pause as of profound mental labour*). Yes, *sir*. A man has to learn what he knows. . . . A man ain't got to care what Bob Ingersoll says; nor yet what Moses says; nor what Beecher says. He's got to find it out for himself. . . . It's so with every man. . . . He may be bald like that old coot over there (*pointing*), or be as thick of wool as a nigger—or he may be grey—or brown—or black haired. . . . I don't care (*reflectively*) if he's tall or short—or if his eyes is blue or black or grey. . . You bet it's all one. . . . He's got to find out all he knows." (*Hiccoughs.*)

P. I. (*Taking advantage of a pause in the sluggish flow of the other's eloquence.*) "*Say*, old man, let's have another drink."

W. I. "Not now, I won't. I'll drink when I want to, not else" (*angrily*).

WOMAN (*gently*). "Sh—sh! you distarb ze peoples."

W. I. "I don't care a lamb's mother (one of the monosyllabic kind) for ze peoples. I didn't ask them to come—and (*gloomily*) I don't care a curse* how soon they go."

P. I. (*After a pause, during which he seemed to eye W. I. rather doubtfully, as if thinking he might by chance have taken one drop too much.*) "What are they laughing at now?"

Just here there had been the usual by-play on the stage. Serpolette pulls the pen from behind the Notary's ear, who exclaims: "*Ne me déplumez pas, mademoiselle; ne me déplumez pas!*"

W. I. "If they'd talk in English we should know what it was all about. How much is there of this thing any way?"

W. I. tries to recall the subject he had been dealing with before. Remembering it suddenly, he resumes.

W. I. "Well, I was a-saying as every man has to learn all he knows. I remember I was down in Iowa once—down in Iowa I was—and I met a man there—a Buckeye. Yes, sir, he came from Chillicothe, Ohio. I had thirteen thousand dollars, greenbacks—and he had fourteen thousand in bonds. Well, sir, we got a-talking about jest this pint of philosophy, and he says, 'Bloss,' he says—that's my given name, Bloss

* Here the well-read reader recalls at once Chaucer's "He sette not a kers." Our "curse" used in this way is simply a profane corruption for the old English "kers" for "cress;" "he cared not a cress," "he recked not a rush," and so on.

is; the other's my other name, but Bloss is my given name —'you know me, don't you?'" (*doubtingly*).

P. I. "You bet I do."

W. I. "Well, I was a-saying. This Buckeye, he says, 'Bloss,' he says, 'a man has to pay for what he learns. And you bet thet's so. Every man has to pay. I don't mind who he is. Every man has to pay just the same! (*A pause for further reflection on this point.*) . . . And if he's a fool he has to pay a damd sight more."

P. I. "Thet's real true—yes, sir, thet's so."

W. I. "You bet it is. I don't care what a man has. He may have five dollars or five hundred thousand—it comes to just the same. Now this man (*pointing at me, or in my direction*), he mayn't know what a hundred dollars is."

P. I. (*enthusiastically*). "Thet's *so*."

W. I. "No, sir (*dreamily, having apparently lost the thread of his discourse, which was unfortunate, as he had not made much progress so far*). He doesn't know anything at all about it. . . . Some men never earned a dollar in their lives. I despise that lot . . . I don't mind what a man has, so he's earned it. . . . Not if he ain't nary a cent. . . . What is it Burns says? 'A man's a man, if he's only in a nutshell, and eh that, and eh that'" (a quotation not generally known; I give it as he gave it). "Yes, *sir*—'a man's a man for eh that.'"

P. I. "You bet." (*In a subdued voice, as of one moved by a solemn truth*).

. . . . . .

W. I. "What are all them gells about now?—them in tights? What *are* they anyway?"

P. I. "I saw some like them at the op'rer a month ago. They called them paggies (query, pages?) in the bill; but these don't seem quite right."

W. I. "Paggies! (*thoughtfully*). . . . Is that so? (*A pause; then still more thoughtfully*) I *want* to know."

. . . . . .

W. I. "This is all durned rot. That would do for a joss-house" (referring to the phantom scene).

P. I. "Shall we go?"

W. I. "I guess we've had about enough."

P. I. "Shall we go, marm?"

Woman. "I shall be vell content."

They rise to go.

Myself (*sotto voce*). "Thank Heaven!" (*Music suddenly ceases.* W. I., with a drunken man's keen hearing, catches my words, and resents my pious aspiration.)

W. I. (*suspiciously*). "Stranger, what are you a-thanking Heaven for?"

Myself (*blandly*). "For all mercies, past, present, and to come—or go, as the case may be."

W. I. "I don't know so much about that."

Myself. "About thanking Heaven?"

W. I. "A man may thank Heaven. So he may."

Myself. "So I should imagine."

W. I. (*effusively*). "Say, stranger! Won't you smile?" (I had been smiling unremittingly; I could not help it. But in America "smiling," "seeing a man," and "liquoring up" are all one.)

Myself (*anxious not to lose Mézières' fine acting, and therefore turning to stage*). "No, thank you. I have left off smiling for to-day."

Exeunt slowly W. I., P. I., and Woman, W. I. saying meditatively, as he passed from behind me, "I don't quite make that stranger out. He seems to me sorter ambiguous like."

P. I. "Here's your hat."

W. I. "Thet's so" . . . (contemplating it as one might contemplate a long-lost friend) . . . "Yes, sir, that's my hat."

Woman. "An' your gra' coat."

W. I. (*same business*). "Yes; that's my overcoat."

If the reader is half as weary of my wholly and partially intoxicated friends, and the nonsense they talked, as I was, he will appreciate the possibilities of annoyance in an American theatre. Yet not one of a score of persons around who lost the performance they had come to see, through the ignorance and stupidity of these two louts, addressed any remarks to them, or made any suggestion as to their withdrawal.

I may remark that the word "paggies" is here interpreted as I suppose it was meant. Pages are not very familiar in the Western States, and I suppose one of my louts, seeing the word "pages" in a playbill, and conscious that the pages of a book were not referred to, concluded that some foreign kind of servitors were meant, and that the word was to be pronounced with a hard "g" to distinguish it from printed pages. But one is apt to make mistakes about such matters, and my friend's "paggies" may have meant something else.*

Next month my "Notes on Americanisms" will be continued in glossary form.

BIRTH OF THE SUN.

To the legends of the sun-god's birth referred to in the last three numbers many others might be added. In fact, there are innumerable stories of the same kind, relating to the birth and babyhood of sun gods, or solar heroes, or persons who (long after their death) were regarded as divine, and therefore as necessarily distinguished by all such attributes as ancient solar religions had assigned to the God of the Day and of the Year. In the old world, as well as in the new, the same ideas naturally arose, and were as naturally extended to persons who had been distinguished during their lives as teachers or as legislators, and around whom after their death traditions belonging to far earlier days came naturally to cling. Let these examples, however, suffice.

Before leaving the consideration of the circumstances attending the birth of the sun-god, one point remains to be noticed. It would be natural, of course, in the history of the birth of the actual sun-god—whether as born at morn (the dark cave of night being his birthplace), or as born at the opening of the year in the midst of the dark and cold cave of winter—that the glory of the sun should be mentioned. This in the account of persons regarded as divine, and therefore as showing the signs of the godhead visibly, would suggest naturally the idea of a bright light surrounding the child at its birth. All lesser lights also would disappear in the presence of this more glorious illumination. The disappearance of the lesser lights has been regarded as explaining the idea of the slaughter of other children by the tyrant Kansa, in order that Crishna, whose future power had been predicted, should be destroyed also. In the case of nearly every solar hero, and also in the case of many persons more or less historic to whom solar characteristics were afterwards assigned, we find the same idea, either as a story relating to a decree for destroying other children born at the

* There is an odd example in "David Copperfield" of a correctly noted but misunderstood oddity of expression—at least so I imagine. Barkis, talking of young Copperfield, speaks of him as a "young Roeshus," "by which," says David—that is, Dickens—"I think he meant prodigy." It seems likely that Dickens had heard the expression, just as he had heard "Mawther," when at Yarmouth, and supposed it to be Norfolk dialect, quoting and explaining it in the same way that he explains words really belonging to Eastern Counties' talk. But probably, whoever used the word in Dickens's hearing, as Barkis is made to do, meant "young Roscius." At about the time when "David Copperfield" was written the "young Roscius" was talked about all over England.

same time, or in reference to measures taken to destroy by exposure or otherwise the child itself whose predicted power was feared. In one or other form the idea appears in every solar story, and in all solarised biographies—if I may be allowed, for convenience, to coin such an expression. As regards the bright light attending the birth of the solar hero, or of the solarised teacher or legislator, we have a number of curious illustrations.

When Crishna was born, his mother became resplendent (remember here how the rays of the rising sun at the winter solstice shone full upon Virgo). The whole cave was splendidly illuminated, says the Vishnu Purana, "the quarters of the horizon were irradiated with joy—the spirits and nymphs of heaven danced and sang, the clouds emitted low, pleasing sounds." Beal, in his "History of the Buddha," relates how, according to Buddhist traditions, when the Saviour of the world was born, "a divine light diffused itself around his person, the Blessed One being heralded into the world by a supernatural light." Zoroaster, the great teacher, of whom later it was found that he sprang from an immaculate conception by a ray of divine reason, was no sooner born than the glory arising from his body enlightened the whole room, and he laughed joyfully at his mother (Laughter and Light were and are closely associated in the oriental mind). The legends of the Hebrew patriarchs relate that at the birth of Moses a bright light appeared and shone all around him; his subsequent adornment with "horns" or rays will be remembered by all readers of the Greek and Latin versions of the Old Testament.

In early Christian art we find the same idea associated with the birth of Christ. The gospel, however, in which the event is recorded, is no longer regarded as canonical. Indeed, nothing but an amazing intensification of Augustine's power of believing, *because* a matter was beyond belief ("*Credo quia incredibile*," he said), would enable men to accept the Protevangelion. Thus does the story run in that apocryphal gospel:—When Mary and Joseph were still three miles from Bethlehem, and "in a desert place," Mary said to Joseph, "Take me down from off the ass, for that which is within me mightily presses me." Then he took her down from off the ass, and found there a cave and put her into it. He went towards Bethlehem for a midwife, and brought one back with him. As they neared the cave a bright cloud was seen over it. "But on a sudden the cloud became a great light in the cave, so that their eyes could not bear it."

It is noteworthy that Tertullian, Jerome, and other of the Fathers state that Christ was born in a cave, and add that "*the heathen celebrated, in their day, the birth and mysteries of their Lord and Saviour Adonis in this very cave near Bethlehem!*" Canon Farrar appears to lean to the idea that the old tradition was right, and that "the actual place of Christ's birth was a cave," the same which "used to be shown as the scene of the event even so early as the time of Justin Martyr (A.D. 150)"—a dangerous doctrine, one would suppose.

Under the very appropriate title of "The Handy Map of the Moon," Messrs. Horne, Thornthwaite, & Wood have just brought out a platinotype reproduction of a large chart of our satellite, drawn by Mr. T. K. Mellor, F.R.A.S. The image of the moon in this capital map is about 11·4 inches in diameter; and the names of something like three hundred of the principal formations are legibly and conspicuously written against them upon it. It would be difficult to devise anything more useful and convenient for reference, by the light of a lantern, to the young working selenographer, inasmuch as not the slightest crowding or confusion is perceptible in any part of the map.

THE NATURALIST'S LABORATORY.

Contribution IV.

IN continuation of the subject of suitable illuminators for the laboratory, we have yet to discuss the various forms of gas lamps and burners of the most approved types.

As to the gas itself, many important inventions have been instituted in recent years to economise in consumption and to increase in illuminating power. Many of the bye-products of distillation which are lost during the process of manufacture of the gas are of the first importance when the intensity of its light is taken into consideration, and lamps have been constructed to restore the naphthalene in the case of the well-known albo-carbon burner, whilst the so-called similar "carboleine" is made use of in Weston's patent "Omega" and the "Carburetter Lamp." By these means considerable saving is effected; as much as twice the illuminating power is produced at about one-third of the original expense. It is well for those who use gas also to know of the existence of governors for regulating the pressure of supply to the domestic pipes, as such variations cannot always be avoided in the gas mains. Undoubtedly the best form of apparatus in the market is that called after its inventor, the "Stott" self-acting gas valve. The object of this invention is to prevent over-pressure and the consequent waste therefrom. The *modus operandi* is:—Any excessive pressure immediately acts on an inverted cup, sealed in an annular trough filled with quicksilver. To the centre of the inverted cup is attached a spindle, at the bottom end of which is a double-beat valve, a high pressure raising the inverted cup, and thus closing the valve, while a low pressure allows it to fall, thus opening it; for instance, if 50 out of 100 lights be turned off there will be a corresponding increase of pressure on the inverted cup, raising and thereby closing the valve partially, so that for every light turned off or on, or any increase or decrease at the street mains, there is a corresponding opening or closing of the valve in the governor, the pressure at the burner thus being the same under any circumstances, and the result being a saving of from 10 to 30 per cent., varying according to the pressure at which the gas is supplied to the consumers.

The form of the gas-burner is said by Dr. A. Vernon Harcourt to have added in the cases of the fishtail, batwing, and Argand types, "as much as 20 or even 50 per cent. to the light obtainable or commonly obtained from a given consumption of gas. To produce a steady and brilliant flame the gas must issue in a slow stream and spread into a sheet, fan-shaped or cylindrical, of suitable thickness, so that the hydrocarbons may be decomposed by heat and partial combustion along the central plane, and the resulting smoke may continue to burn and glow as it spreads outwards for as long as is consistent with the development of a sufficiently high temperature, and then may meet the outer air so suddenly and over so large a surface as to be completely consumed."

Burners are also made by means of which heated air is supplied to the flame, as already alluded to, in order to increase its illuminating power. It has been found that the ordinary gas-burner in general use does not provide sufficient heat for the ignition and complete combustion of the carbonated gas, so that a waste of material results, and with the loss of light the atmosphere becomes polluted by the products of combustion added to by liberated free gas, and thus the apartment is liable to be filled with a noxious element and a powerful anæsthetic — conditions which operate directly to make one drowsy and weak. To effectually prevent both of these evils, and to gain fresh light, Dr. Sir William Siemens and Herr F. Siemens conducted a series of exhaustive experiments, with the result which is now known as the "Regenerative System," which consists in supplying the flame with heated air and gas to enable it to effect complete decomposition of the carboniferous gas. "The apparatus comprises three parts: the *burner* proper, the *regenerator* (in which the gas and air necessary for the combustion is previously heated) in contact with the sides of the *flue*, which sucks down and carries off the products of combustion. The burner is formed by a ring of small vertical copper tubes of about three-sixteenths of an inch in diameter, and of which the number varies from sixteen to thirty-two, according to the size of the apparatus. The gas, in passing up these tubes, becomes still more heated without acquiring a sufficiently high temperature to become decomposed. The relatively large diameter of the burner tubes has the double advantage of preventing any deposit of soot and of checking the too rapid flow of gas. The products of combustion are continuously returned by a downward current to the interior of the burner itself, and there utilised to heat fresh gas and air prior to use. The result is that combustion by this method is absolutely perfect.* These regenerative gas-burners need not be ungainly in appearance; on the contrary, there is even scope for increased elegance of design. It may be worthy of suggestion here that the fittings of the laboratory ought always to embrace artistic principles where practicable, for labour, like digestion, is accelerated when general sensation is rendered suitably pleasant.

The incandescent electric light in vacuo, however, must be acknowledged, *una voce*, to be the best for all domestic purposes, including the illumination of the laboratory, since it cannot impair the atmosphere by consuming oxygen and emitting injurious products. Its invention by Swan and Edison in 1877 now bids fairly to supersede the employment of all other illuminants, but the costliness of the methods in use, and the many technical difficulties yet to be overcome in its several practical applications and the efficient education of workmen and others, makes its universal introduction even in London for many years to come extremely problematical. For these reasons the subject of lighting with oil and gas has been treated of in detail, and it is probable that with the spread of knowledge of the principles of thorough ventilation and warming in relation to the forms of apparatus now used, *e.g.*, the "Defries" lamp, the "Albo-carbon," "Omega," "Carburetter," and "Siemens's Regenerative Burner," that oil and gas will continue to hold their places indefinitely as domestic illuminants.

Under the heading of "Hygienic Comparisons between Gas and Electric Light," the following extract is at least noteworthy:—"Some interesting experiments, we learn from the *Builder*, have been recently made at the Royal Theatre, Munich, in order to determine the elevation of temperature and amount of carbonic acid generated under illumination by gas and the electric light respectively. Before the performance commenced the curtain was raised, and all the lamps allowed to burn for an hour, at the end of which time the temperature was observed at intervals of five minutes simultaneously in the parquet, balcony, and third gallery. During the performance, when from five hundred to six hundred persons were in the theatre, the thermometer was observed every ten minutes. The experiments showed that the electric light greatly diminishes the increase of temperature. It does not render ventilation superfluous, but it requires a less active ventilation than gas, since it does not, like gas, contribute to the increase of heat and carbonic acid.*

With all the appliances above mentioned in good working order, there yet remain many seemingly trivial items to be carefully attended to in shielding the laboratory from the incursion of dust and dirt, undue moisture, and other things which have a direct bearing upon the *comfort* as well as the *health* of the student. The prevalent forms of wall decorations and floor coverings employed seem to be especially adapted to the accumulation of filth, whilst many of them are active disease-producing agents. Undue moisture in the air is well known to be a fertile cause of failure in delicate experiments—*e.g.* the pure culture of germs, and the preservation of implements, books, chemicals, &c., from premature oxidation, mouldy growths, and general decay. Moist air thus operates powerfully in physical disintegration, and in supporting myriads of objectionable organic creatures. The remedy need not be expensive, although a costly initial outlay would be saving in the long run, in consideration of its permanent value.

All the woodwork, both exposed and hidden, ought to be rendered impervious and stable by being suitably painted or varnished. This applies as much to the flooring as to the doors, cupboards if any, window-frames, and wall-skirtings. Furniture, as a rule, is always so treated, with but few exceptions, to be noted in the sequel. The paint selected should be non-poisonous,† fire and damp proof, washable, perfectly adhesive with a good body, and not liable to scale off or blister through changes in the weather, &c. The harmless basis known as "Charlton white" may be used in place of the poisonous white lead, and care should be taken to procure non-poisonous driers for use with it. All the good qualities noted, however, are exemplified in "Thompson's magnetic oxide of iron paint" and "granitic paint," with the exception of fire-protective property; the latter can be additionally secured by the preliminary use, as a priming, of the "Patent Liquid Fireproof Cyanite." For the ceiling a washable sanitary distemper, such as the "Silicate Zopissa Composition," ought to be used.

The walls of the laboratory should preferably be painted with some one of the materials already mentioned, and, as the selection and blending of colours can be very tastefully displayed, wall-papers may be dispensed with. Paper, however, is much cheaper than paint, and affords a much larger field for artistic skill; but health and comfort must not give place to the false economy of cheap poisonous wall-papers. Where paper is used the wall ought to be previously lined with an impervious film or coat. "Silicate Zopissa Composition" or "Eastwood's Damp-proof Paper" may be used profitably as sub-linings. The paper itself should be non-poisonous, washable, and free from rough embossed or similar raised work, which is liable to harbour dust. Any kind of paper can now be procured or rendered washable by the leading dealers in such things. Arsenical papers should be avoided; they are not necessarily green in colour—indeed the opposite is now generally found to be the case. It is well known that arsenic, when taken internally in homœopathic doses, is an excellent tonic and skin-purifier, and Mattieu Williams has doubted whether arsenical wall-papers may not, instead of being injurious, prove actually beneficial! There is much truth in the question thus raised, and many arsenical wall-papers may distinctly be shown to be health-giving;

* "Gas Lighting of the Future," pp. 2, 3. 2nd edit. London: 1882.

* "The Illustrated Science Monthly," London, April 1885, vol. iii., p. 120.

† It has been urged that poisonous paints, such as white lead, the basis of ordinary shades of colours, are harmful only when wet, but apart from the fact that this is not strictly true, that circumstance alone should be a sufficient condemnation, most of all in the interests of our labouring artists.

but as many, if not more, are clearly baneful, so that arsenic should never be administered in this way; its use should be exclusively regulated by the physician and chemist, and when present in wall-papers they ought to be unhesitatingly condemned.

Gossip.

By Richard A. Proctor.

The great earthquakes in Europe and America have brought out the customary supply of prophets after the event, and the customary amount of contradiction in regard to the future—immediate and remote. It need hardly be said, however, that no true student of science, no one indeed having any recognised standing in scientific circles, has joined in the idle chatter by which the Wigginses, Tices, Grimmers, Saxbys, *et id genus omne*, endeavour on these occasions to acquire notoriety since they cannot achieve fame.

* * *

In America Mr. Wiggins, of Ottawa, a half-educated but wholly unscientific man, an *employé* in the Meteorological Office, has been at the pains of announcing a yet more destructive earthquake (in latitude thirty degrees north, in America) than the one by which Charleston suffered so terribly. This might be regarded as mere folly and not condemned as wicked, were it not that, as this man cannot but know, the inhabitants of the disturbed district have suffered from terrible anxieties and fears ever since the earthquakes took place. Many deaths must be attributed to this cause alone, and there have been three (reported) cases of insanity resulting from fright. For a man at such a time to make predictions which he knows to be the merest guesses, simply to gain notoriety, and with the certainty that he must cause much serious mischief—for the weak and foolish are always with us—is the meanest wickedness of which the false-weather prophets and their kind have yet been guilty.

* * *

As I write, news is received from New Orleans that an aëronaut advertises the sale of seats in the car of his balloon on the day appointed by Mr. Wiggins for the destruction of that city.

* * *

I am asked by some correspondents why some scientific matters which bear to some degree on theology are admitted here, and especially the myths of ancient races on which many of the leading religions of the world have been based, and yet theological essays are not admitted. It would be entirely to change the plan of Knowledge to do so. Theology presents as knowable that which we can only treat here as unknowable. To decide between the various dogmas of the theologies of diverse religions would be to pretend to determine what we regard as absolutely beyond the range of human knowledge. If I touch here on matters which many suppose to be associated with religion, and especially to bear on the question whether such and such books and teachings are inspired, I do so strictly because of the scientific bearings of such matters. I personally take no interest in the theological questions on which some of these matters are supposed to bear. If anyone objects to a scientific statement about facts because he cannot reconcile it with his own ideas about matters theological, I may be at the pains to point out that the facts alone concern us here. And such a reply can, of course, be misinterpreted into an attack on some theological dogma. But this is as far from the truth as, for example, the idea would be that Sir John Herschel in measuring the sun's heat was, in point of fact, endeavouring to throw doubts on the tenets of those who worship the sun as a god.

* * *

The small-minded folk who invent out of their own minds a feeble-minded deity, the ignorant who treat as inspired the ideas of men as ignorant in past ages as they (more discreditably) are now, attract much less of the attention of students of science than many fondly imagine.

* * *

I have been long on the look-out for a cricket match in which an innings of double figures should be played; but I have looked in vain (though I know a few such innings are on record) till the recent match between the Australians and an All England eleven at Scarborough, when, as every one knows, the English eleven not only all reached double figures, but all save one passed the score, while none reached treble figures, and the extras reached double figures as well as the individual scores.

* * *

A writer in the *Times*, commenting on my remark two or three years ago that an innings of double figures is thus unusual, seems to draw an erroneous distinction between a case such as this and an ordinary problem in probabilities. He says:—

> Some two or three years ago Mr. Proctor, in Knowledge, stated that no cricket score marking double figures all down the innings had ever come under his observation. The England *v.* Australia match of Friday last supplies the exceptional case. The Yarborough hand at whist does not, I think, justify the traditional odds of 1,000 to 1. This is a matter of pure chance; but that the double-figure record should be unique among picked elevens suggests a curious problem in personal equations. The failure, where single or double only, is never in extras.

But in reality such a problem as this must be regarded as simply a problem in probabilities. Though the chance that an individual player will make a double-figure innings in any given match depends on his skill and the skill of the opposing eleven, yet it remains a chance—nay, in a sense it may be said to be more thoroughly a matter of chance than the tossing of head or tail—seeing that not only is it a chance whether the irresistible ball will come early or late, but it is a chance whether the player will be in his customary form, and even whether previous matches, on which an estimate of his skill has been formed, have really given satisfactory and sufficient means of testing it.

* * *

As a problem in chances one may deal with the case in the following manner, though, of course, opinions will vary as to the averages suggested, and in each match, considered separately, the averages here indicated will be departed from:—

Suppose that, on the average, in every cricket match (between elevens), two players out of an eleven may be expected to reach double figures in 7 cases out of 10, two others in 5 cases out of 10, three others in 3 cases out of 10, two others in 2 cases out of 10, and the remaining two once only in 10 cases. Let us further suppose that the chance of that one, whoever he may be, who is *not out* at the end of the innings, is reduced one half by the possibility that the failure of the player *last out* may occur before the *not out* has reached double figures. Further, let the chance of double figures in "extras" be set at 6 in 10. Then the chance that all the eleven players make double figures, including the *not out*, and that the "extras" run to double figures too, is obtained by multiplying together the chances of the several events, which amount, in all, to 13—viz. 11 for the several players, 1 for the *not out's* extra chance of failure, and 1 for the extras. It is therefore represented by

$$\tfrac{7}{10} \times \tfrac{7}{10} \times \tfrac{5}{10} \times \tfrac{5}{10} \times \tfrac{3}{10} \times \tfrac{3}{10} \times \tfrac{3}{10} \times \tfrac{2}{10} \times \tfrac{2}{10} \times \tfrac{1}{10} \times \tfrac{1}{10} \times \tfrac{5}{10} \times \tfrac{6}{10}$$
$$= \tfrac{3969}{10,000,000,000}$$

or the chance is less than 1 in 2,500,000 that the double-figure result will come off.

* * *

Of course in special cases the chance would be much higher than this, as when a strong eleven with no tail is opposed to a weak one. It would be a very exceptional eleven, however, for which the above chance would be altered into, say—

$$\tfrac{8}{9} \times \tfrac{8}{9} \times \tfrac{8}{9} \times \tfrac{6}{10} \times \tfrac{6}{10} \times \tfrac{5}{10} \times \tfrac{5}{10} \times \tfrac{5}{10} \times \tfrac{3}{8} \times \tfrac{3}{8} \times \tfrac{3}{8} \times \tfrac{5}{10} + \tfrac{6}{10}$$
$$= \tfrac{1}{200} ;$$

in other words, the odds against making all double figures would be close on 200 to 1 even in the case of an eleven so strong (as against the opposed eleven) that three of the number would reach double figures eight times out of nine, that two would reach them three times out of five, three in half the number of games played, and the three others three times out of eight.

* * *

The odds against a "Yarborough" are more than 1,827 to 1, though I do not say that would "justify" laying even 1,000 to 1 against an event which may occur at the first trial. I have known two Yarboroughs (*i.e.* whist hands without a card above a nine) in one evening's play.

* * *

The victory of Beach over Hanlan on the Paramatta, and over all competitors on the Thames, gives pleasure to those who have been long troubled by the crafty ways of certain professional oarsmen. The river has been infested by sporting rascality as thoroughly as the turf; and those who have taken interest in rowing and sculling races because of their regard for a manly exercise, and without any of those gambling tendencies which degrade sporting men, have been little aware how often the pulling is arranged before a stroke has been taken. Beach has, and doubtless deserves, the reputation of thorough straightness. If or when he is beaten—long may it be before he is—we shall know that he has been beaten by a better oarsman.

* * *

For my own part, I feel further pleasure in Beach's success because all accounts agree in describing his stroke as precisely that which I have advocated on theoretical grounds as the stroke which must certainly be most effective for the modern racing craft—a strong grip at the beginning, and the best part of the work done in the first half of the stroke. Although very absurd ideas were mistakenly advanced about Hanlan's stroke, as involving a jerk at the end—ideas which, being accepted by other oarsmen in America, have gone far to ruin their style (which probably was intended)—there can be no doubt that Hanlan did more work proportionately in the latter half of his stroke than the mechanical theory of propulsion would justify in light-racing craft, or than any man not so exceptionally built as Hanlan could have ventured on. Whenever Hanlan was fairly extended, however (how seldom that happened we all know), his style was nearly perfect. Beach rows in a style as nearly perfect as seems possible; and his method is that which, since the days when the modern racing-boat was introduced, all the best oarsmen have followed.

* * *

I quote the following account of Beach's rowing from the *Referee*; because, although the remarks on rowing in that paper have always read to oarsmen as if penned by theatrical "supes," or at best by sprinters as the nearest approach to athletes possible with their staff, yet as the *Referee* was formerly obliging enough to comment unfavourably on my own views in regard to rowing (who have, I suspect, rowed more miles than any of their staff have written lines) it is pleasing to be able to quote from that paper what amounts, practically, to a recantation, as the following parallel columns will show:—

From "Notes on Rowing" in the Editor's "Strength and Happiness," pp. 161 and 162:—

I assert confidently, as a result of theory and practice, of observation and of experiment, that for the arms not to be at work in connexion with the body and legs in the earlier part of the stroke is as great a fault in rowing as for them to be at work alone in any part of the stroke. . . . [The rower in the modern light craft should] give up the cherished drag and lightning feather, let the arms be sturdily called into action, in due subordination of course to the body, and in due alliance with the legs from the very beginning of the stroke, so that when the body comes upright the arms have nearly done their werk. Let not the stroke be hurried, but a steady (not sluggish) recovery precede the grip at the beginning.

From the *Referee* for September 5, p. 1, col. 4:—

Like Renforth, Beach is very quick in catching hold of the water, and, as did the Novocastrian, lays on directly he has hold. He pulls hard on his stroke throughout, but does most of his work, as oldsters used, in the first half, and not in the second, as the new school do. This development upsets all done in the last few years. The American school went farther than Hanlan, whose vicious wrench at the end of each stroke was one of its chief features. Beach has dropped into the old style, with most of the work done with the sculls at right angles to the boat's line, but a start made in earnest directly they are dropped in. This does not necessitate scamping the remainder, but as carried out is the way that the heroes of the previous generation performed.

* * *

Besides the method of arranging 19 trees in 9 rows, 5 in each, described under the head "Our Puzzles," I have received yet another, fulfilling, oddly enough, the condition I mention as only fulfilled by original solution. I will give this next month, with the solution of the more difficult problem to arrange 19 trees in *ten* rows 5 in each.

* * *

Some readers appear quite to have mistaken several references to my esteemed friend and contributor Mr. Grant Allen in our last. Surely it ought not to need explanation that if I mention him as doing (with marvellous skill and aptitude) what the *Saturday Review* is constantly attacking me for doing, no reproach can conceivably be intended. The remark as to incorrectness in West Indian speech brings Mr. Allen into the same relation with Thackeray and Anthony Trollope, to imagine which to be a slur were assuredly absurd.

Reviews.

Essays in the Study of Folk-Songs. By the Countess Evelyn Martinengo-Cesaresco. (Geo. Redway.)—The essays which compose this delightful book well deserve collection in permanent form, and the publisher has done his share in making that form attractive. Their subjects carry us back to the morning of the world, when the inspiration of the singer came through direct contact with nature, and we are among the company of those whose verse, spontaneous and sincere, is to the poetry of later days as the wildflowers of valleys and meadows to the cultivated beds of parks and hothouses. Their themes are not of intrigues and low ambitions of an artificial state, but of childhood and love, and the death that blights both; of the fate of men swayed by the gods; of the intercommunion of all living things; of nature in storm and calm, seed-time and harvest —all imbedding many an old-world superstition, worn-out custom, or still active belief. Whilst the authoress has presented her matter with literary skill, she has not permitted this to obscure the historic spirit in which her many felicitous illustrations are interpreted. They are drawn from varied sources—from the far north to the islands of the Pacific—but the larger number are chosen from the rich stores of districts familiar to her, more especially Southern Europe, where the shepherds and the vineyard-dressers have not cast aside the reed of Pan. Very touching are the specimens of lullabies and dirges, very pretty the love-songs and popular lyrics of Venice and Sicily and Calabria, but, as combining philosophic treatment with recognition of deep human interest, we commend the chapter on the Idea of Fate in Southern traditions. Altogether a book alike for the specialist in folk-lore and for the general reader.

Hester's Venture. By the Author of "The Atelier du Lys," &c. (Longmans.)—It would be unreasonable to expect that the high level reached in "Mademoiselle Mori" should be maintained in every subsequent book from the skilful hand that gave us that powerful story; but if the materials of the present tale are more commonplace, the investment of them with an interest that increases as the story advances only witnesses the more to the author's mastery and skill. If there is little to excite, there is enough to attract, in the characters whose friction in the mild intercourse of a Cornish watering-place gives movement to the story. What set of circumstances led to Hester's venture, what was its nature, its strange surroundings and results, must be left to the reader to find out. Both the heroine and her dear old grandmother, the one in her quiet self-dependence, and the other stilled by the patience which is not always the fruit of life's discipline, are attractive enough to keep our sympathies in their fortunes awake, while the contrast presented by the other characters, all life-like in portraiture, from the successful German who vexes the jealous soul of the squire with his schemes for improving the old town, to the mild villain of the story, and the beautiful actress in her Bohemian home in London, complete the lights and shades of a novel which is far above the average.

Still higher amongst the author's works rank the *Atelier du Lys* and *In the Olden Time*, which Messrs. Longmans have issued in half a crown editions, printed in clear type and stylishly bound. The vivid incidents of the one are set in a graphic description of the state of France under the Revolution of '93, while in the other the revolt of the frightfully oppressed peasantry of Germany in the early part of the sixteenth century is the framework of the pathetic story of the concealed Rosilde and the leper *Meistersinger*.

The Dawn of the Nineteenth Century in England. By John Ashton. Popular Edition. (T. Fisher Unwin.)—If Mr. Ashton cannot write history, he can skilfully sift and arrange its materials, and leave on the mind of any intelligent reader a clear impression of the period from which they are gathered. He has in the present work unearthed from newspapers and other fugitive literature of the early years of this century a mass of curious information concerning the social condition of the people, the rigour of the laws under which they lived, and the burden of taxation under which they were crushed. If there be any *laudator temporis acti* among the readers of Knowledge, he may find many a fond delusion dispelled by the facts Mr. Ashton has focussed together, and be thankful that his lot was not cast in the years when the quartern loaf stood at *2s. 7d.*, the income-tax at *2s.* in the pound, and coals at *48s.* per ton; when the New River turned on its water supply three times weekly; when the streets were paved with kidney-stones and lit with oil lamps, and locomotion had made no advance since the day when Joseph was carried into Egypt; when a debtor might languish for life in prison, and a man be hanged for stealing a counterpane or a pair of stockings. The daily life of the streets, the diversions of the people in cockpits and gambling-hells, the fashions of the town with its Bond Street mashers and padded old *roués*—all defile before us in the sketches which make up this entertaining and instructive book.

Old Cookery Books and Ancient Cuisine. By W. Carew Hazlitt. (Elliot Stock.)—There is a certain relation between this book and the foregoing, but, although of smaller compass, it covers a wider range in time. Mr. Hazlitt might have cited the relics of hunting feasts in the Reindeer Period of the Ancient Stone Age, in evidence of the high antiquity of cookery; but he contents himself in his introductory chapter with references to the culinary art in Scripture and the classic writers. We may gather from his pages a clear account of the food of the higher and lower orders of the early English, in whose *menu* dishes strange and repellent to our palates appear. We have, however, happily overcome that prejudice against the hare to which Cæsar refers, and the explanation of which it does not occur to Mr. Hazlitt to assign to a totemic origin. The recipes from old cookery books, which fill several chapters, show that our ancestors were adepts in the art of blending good things together, although Mr. Hazlitt, in admitting how we had to summon foreigners to teach us the proper treatment of our ample materials, indorses the grave charge of the French satirist—that we have many religions but only one sauce! In referring to the "Liber cure Cocorum," he is probably not aware that this quaint metrical cookery-book has been edited by the Rev. Dr. Morris for the Philological Society, and, when speaking of the recipe for "goose in a hog-pot" as leaving one in doubt as to its adaptability to the modern palate, has he not mistaken "hotch-pot" for "hog-pot"? But whether he has or has not done this, he has to be thanked for a book commendable both to the antiquary and the housewife.

Longman's School Geography. By G. G. Chisholm, M.A., B.Sc. (Longmans.)—Geography, to the shame of this empire that holds so much of the world in fee, is about the worst-taught subject in our schools, and the result is manifest in the crass ignorance of nine-tenths of educated (?) people as to the whereabouts and features of places the names of which are familiar enough. We, therefore, give special welcome to the present book, which has for its model the masterly text-books on *Erdkunde* in use in Germany, where, determining what is possible and what is impossible in school years, the overloading of the mind with minute detail is wisely subordinated to thoroughness in laying the groundwork. Hence, as Mr. Chisholm says, "the present work will perhaps appear more remarkable for what it omits than what it contains," but he has at least retained what it is most important to know. The information, both in the physical and political sections, is posted up to date, and there are some woodcuts good enough of their kind, but in the room of which we should have preferred a series of block maps. The book is certainly one which should forthwith supersede the majority of manuals in current use.

After London, or Wild England. By Richard Jefferies. (Cassell & Co.)—The undercurrent of melancholy which runs through much of Mr. Jefferies's writings is in full swing in this weird picture of an England which has relapsed into barbarism, and in which only the scantiest relics of civilisation have survived as curiosities, not even an arch of London Bridge being left on which Macaulay's New Zealander might sit to sketch the site of the vanished city. For in Mr. Jefferies's vision London is covered by marshy ooze, from whose putrid mass is exhaled mephitic vapours fatal to the man who nears its borders, and to the bird that flies across it, and hanging as a low cloud over the rottenness of a thousand years and of many hundred millions of human beings festering under the stagnant waters charged with sewage, and like foul matter. What natural causes operated to bring about this catastrophe are described in the first part, and a piece of very powerful writing it is. The second part introduces us somewhat abruptly to the domestic life of the Aquilas, one of the few surviving families of nobles dragging on an Ishmael-like existence, and the prey of a rapacious tyranny which has usurped sway over "Wild England." As the fortunes of Felix Aquila in his perilous adventures for love's dear sake await their sequel, Mr. Jefferies's readers may in the meantime exercise their ingenuity in discovering whether any or what subtle meaning underlies his fantastic story.

Pendennis. Barry Lyndon. The Newcomes. (Smith, Elder, & Co.)—This convenient and pretty reprint of the great master has beguiled us into renewed reading of works that cannot pall, and that, while never obtruding their moral, tend to lift us out of life's littlenesses into a larger, wholesomer sphere. Whether the more expensive editions be possessed or not, this pocket edition should have a corner of its own.

A New Theory of Astronomy. (Dublin: P. Dixon Hardy & Sons. London: Piper, Stephenson, & Co. 1857.)—We fail to find the slightest justification for the insult offered to a scientific periodical in sending to it for notice such unmitigated trash as this twenty-nine years after the date of its publication.

Papers in Inorganic Chemistry, with Numerical Answers. By GEO. E. R. ELLIS, F.C.S. (London: Rivingtons. 1886.) Yet another aid to the grievously over-examined student! It is only fair, however, to say that any one who can intelligently answer the progressive series of questions contained in Mr. Ellis's volume (as carefully contradistinguished from answering them by rote) must have previously acquired a sound knowledge of elementary chemistry.

Philips' Planisphere, showing the principal Stars visible for every Hour in the Year. (London: Geo. Philip & Son.)—This extremely handy little planisphere is excellently adapted to its purpose, which is to show at a glance the visible heavens at any given hour of the day or night in and about the latitude of London; or, in fact, for practical purposes, in any part of England. The disc on which the constellations are delineated rotates in a leather frame, which is perforated with the elliptical projection of the horizon, the the stars of course being visible through this opening. It is the very thing to lie on the astronomer's library table.

Reading-Books for Home and School: Suggestive Lessons in Practical Life. Second and Third Series. (Smith, Elder, & Co.)—These books, both in matter and style, deserve unqualified praise. They are not made up of clippings after the fashion of their kind, but of clear and informing chapters which are the fruit of wide reading and of a lifetime's practical experience in teaching. All the woodcuts are good, and some of them superlatively delicate.

The Junior Students' Algebra. By ALEX. WILSON, M.A. (London: Crosby Lockwood & Co.)—Mr. Wilson has obviously taken immense pains to render the fundamental principles of algebra intelligible to the beginner. His book only extends to simple equations; but his explanations of the various little difficulties which beset the junior student leave nothing to be desired.

The Arithmetical Class Book. Part I. By Rev. T. MITCHESON, B.A. (London: Bemrose and Sons. 1886.)—*Moffatt's Civil Service Examples in Arithmetic.* By J. HALL and E. J. HENCHIE. (London: Moffatt & Paige.—*Exercises on Mensuration.* By T. W. K. START. (London: Sampson Low, Marston, Searle, & Rivington. 1886.)—*Analysis Tables for Chemical Students.* By R. L. TAYLOR, F.C.S. (London: Sampson Low, Marston, Searle, & Rivington. 1886.)—*German of To-day.* By Dr. N. HEINEMANN, F.R.G.S. (London: Cassell & Co. 1886.)—*Shakspeare's Plays.* Text and Literary Introduction in English and German. "King Lear"; "Henry VIII." (London: Whittaker & Co.)—*Le Verre d'Eau.* Par E. SCRIBE. With an Introduction and Notes by A. BARRÈRE. (London: Whittaker & Co.) Yet another pile of school-books, all more or less adapted to their purpose. Among those possessing some particular recommendation we may perhaps select Mr. Mitcheson's "Arithmetic" and Mr. Taylor's "Analysis Tables" as a little above the average. The rest of the works named above call for no special notice.

We have received Vol. VII. of the *Dictionary of National Biography* (reserved for fuller notice).—*Agnostic First Principles*, by IGNOTUS (Albert Simmons) (Watts & Co.), an accurate and much-needed summary of Mr. Herbert Spencer's famous work; the tone of Dr. Bithell's introduction is admirable.—*Outlines of English History* (Moffatt & Paige), a useful whip to jaded memories, although primarily intended to minister to the mind-killing system of "cram."—The second volume of *British Fungi*, by Rev. JOHN STEVENSON (Blackwood & Sons), completing the work.—Mr. Cole's *Studies in Microscopical Science, August and September* (Birmingham: Hammond & Co.), to which every microscopist should subscribe: the plates alone are worth the money.—Ross's *Notes on Fairs*, a gossipy, informing *brochure* on those primitive mixtures of business and frolic.—*British Fungi, Lichens, and Mosses*, by E. M. HOLMES and PETER GRAY (Swan Sonnenschein & Co.), the latest addition to the useful and marvellously cheap "Young Collector" series.—Mr. Harris Teall's *British Petrography*, Parts V., VI., and VII. (Birmingham: Watson & Douglas), enriched with admirable chromo-lithos of olivine-dolerite and felspar from Derbyshire, the Hebrides, and Scotland.—*The Little Asker; or, Learning to Think*, by J. J. WRIGHT (Swan Sonnenschein & Co.), which utilises the more attractive and striking facts of science for moral lessons. Commendably free from unprovable dogmas.—*The Antiquary* (Redway), giving papers of interest on the orientation of churches in Hampshire, on the ancient boat found at Brigg, with illustrations of the relic, and continuing the late Mr. Cornelius Walford's useful "History of Gilds."—Martin's *Ambulance Work* (Baillière, Tindall, & Cox), well worth its shilling for excellent summary of human anatomy and advice as to treatment of accidents.—Professor Guthrie's wise and scathing *Cantor Lectures on Science Teaching.*—A batch of Cassell & Co.'s useful serial issues: *European Butterflies and Moths; Countries of the World; Our Own Country; Library of English Literature; Book of Health.*—From America we have the *Proceedings of the Academy of Natural Sciences*, Philadelphia; the *American Naturalist*; and the *Smithsonian Report*, 1884, with its valuable *résumé* of scientific work and discovery, notable among which are the interesting finds of the oldest known fossil-fish in the lower Silurian beds of Pennsylvania, and of the oldest arachnids represented by fossil-scorpions in the Upper Silurian of Gothland and Lanarkshire.

Our Whist Column.

BY "FIVE OF CLUBS."

MATHEWS ON WHIST.

IT seems desirable, when so much attention is being directed to conventional devices at whist, to turn to the work of one who was a master of whist strategy, and thoroughly well acquainted with all those points of play which constituted the science of whist in his day. That whist has advanced since Mathews's time may doubtless be true. It will be seen, as we proceed with his work, that in several points modern whist differs strategically from the whist of the beginning of this century. But the change has been much less than those suppose who imagine that modern whist owes its scientific superiority to the system of conventional signals. I might even say that the advance has been much less than it would have been had not whist strategy been hampered by a system of cumbrous conventions. I believe many readers of the series of papers in which I am about to present the whist of Mathews will be surprised to find how slight the advance has really been since his time, so far as whist strategy is concerned.

But Mathews's book is unfortunately ill-arranged and ill-written. There is, indeed, no arrangement whatever. If he had written evening after evening on separate scraps of paper such ideas as the progress of successive games suggest, and had afterwards piled these scraps in a box and taken them out at random to make his book, he could hardly have produced a more heterogeneous conglomeration of suggestions. Then some of the suggestions are so ill-worded that they will bear two or three interpretations, and only the whist player who, having gone through the work, has learned to appreciate the vigour of Mathews's strategy can tell precisely what he meant to say. In other cases, however, Mathews has succeeded in laying down in a few lines the whole philosophy of a matter about which some recent authors have written chapters, verbosely presenting views inconsistent with sound whist strategy. This is especially the case with the discard. In what follows I have thoroughly rearranged Mathews's matter; and where necessary I have altered his wording: where I follow him inverted commas are used; square brackets where matter is interpolated, unless the addition is very slight:—

INTRODUCTION.

"Whist is a game of calculation, observation, and position."

"Calculation teaches you to plan your game [at the outset] and lead originally to advantage. Before a card is played you suppose the dealer to have an honour and three other trumps; the others each an honour and two other trumps. The least reflection will show that as it is two to one that your partner has not a named card" [that is any particular card not in your hand] "to lead on the supposition that he has it, is to play against calculation. Whereas, the odds being in favour of his having one of two named cards, you are justified in playing accordingly. Calculation is also of use on other occasions, which the maxims will elucidate. But after a few leads have taken place, calculation is nearly superseded by observation. Where the sets are really good players, they are as well acquainted, before half the cards are played out, with the material cards remaining in each other's hands, as if they had seen them. Where two regular players are matched against two irregular ones, it is nearly the same advantage as if they were permitted to see each other's cards, while the latter were denied the same privilege.

"It is an axiom that the nearer your play approaches to that of dummy" [that is, the nearer your play is to what it would be if your cards were exposed and you played what your partner asked for] "the better."

"Calculation and observation may be called the foundation of the game, and are so nearly mechanical, that any one possessed of a tolerable memory may attain them. The science of position or the art of using calculation and observation with advantage is more difficult. Without it it is evident they are of no use. Attentive study and practice will in some degree ensure success; but genius must be added before the whole finesse of the game can be acquired. However —

Est quiddam prodire tenus, si non datur ultra.

GENERAL PRINCIPLES.

"Study all maxims with the cards placed before you in the situations mentioned. Abstract directions puzzle much oftener than they assist the beginner. General maxims presuppose the game and hand to be commencing. Material changes [during the progress of the game] frequently require that a different mode of play should be adopted. Do not attempt to practise [strategic methods] until you have acquired a competent knowledge of the theory [that is, of the theoretical considerations on which they are based]. Avoid as much as possible sitting down with bad players, for it is more difficult to eradicate erroneous than to acquire just ideas. Do not accustom yourself to judge by consequences. Bad play sometimes succeeds where good play would not. When you see an acknowledged judge of the game play in a manner you do not comprehend, get him to explain his reasons, and while [the case is] fresh en your memory, place the same cards before you. When you can comprehend the case, you will be able to adapt it to similar situations."

"Do not at first puzzle yourself with many calculations. Those hereafter mentioned will be sufficient even for a proficient."

"Observe silently and attentively the different systems of those with whom you commonly play. Few players have not their favourite system, the knowledge of which will give you a constant advantage. One leads by preference from an ace, another never but through necessity. [This will often direct you in putting on king second.] The players of the old school never lead from a single card without six trumps; many do so from weakness [in trumps]. Some have a trick of throwing down high cards to the adversary's lead, and then, by way of deception, affect to consider, though they have no alternative. [This, however, is not so much system as acted falsehood.] Observation will enable you to counteract this, and turn it to your own profit. ['Oh, 'tis the sport to see the engineer hoist with his own petard!']

"At the commencement of a game, if you have a good hand, or if your adversaries are considerably advanced in the score, play a bold game; otherwise, a more cautious one. The first object should be to save the game if it appears in probable danger; the next to win it, if you have a reasonable hope of success, by any mode of play, even though hazardous. If neither of these is in question you should play to the score."

The more plainly you demonstrate your hand to your partner the better. Be particularly cautious not to deceive him in his or your own leads, or when he is likely to have the lead. When it is evident the winning cards are between you and your adversaries play an obscure game, but as clear a one as possible, if your partner has a good hand. A concealed game may now and then succeed in the suits of your adversaries; but this should not be attempted before you have attained considerable proficiency; and then but seldom, as its frequency would destroy the effect.

Let the beginner rest assured that without comprehending the leads, modes of playing sequences [and other points of regular play] with an attentive observation of the table, it is as impossible to make any progress in the science of whist as to learn to spell before he knows the alphabet. He must accustom himself to reason by analogy, as the only way of learning to vary his play according to circumstances: he will find that the best play in some is the worst in other situations of the game.

Avoid equally undue daring and extreme caution. One may see "even good players hazard the game merely to gain the applause of ignorant bystanders, by making as much out of the cards as they are capable of; but this pitiful ambition cannot be too much guarded against. On the other hand, some players will never part with a certain trick, though for the probability of making several; they are like fencers who parry well the attack [but are good only in defence]. No player of this kind can excel, though he may reach mediocrity."

"Lastly, I must repeat my advice to proficients, to vary their play according to the set they are engaged with. Recollect that it would be of no advantage to speak French like Voltaire, if you lived with people who were ignorant of the language."

Modern Whist, together with the Laws of Whist. By CLEMENT DAVIES, M.A. (London: Sampson Low, Marston, & Co. 1886.)—This little treatise might better be called "The Laws of Whist, together with Modern Whist," for it is more than half taken up with the laws (without note or comment). Turning to the very limited amount of matter relating to modern whist, about 7,000 words (or four pages of whist matter in KNOWLEDGE), for which Mr. Davies has the conscience to ask four shillings, we find a good deal of this also to be very far from original. Of the preliminary advice sections 1, 2, and 3 are simply naught—and there are only three sections. The matter on playing to the score is as old as short whist itself, and much of it as old as Hoyle. Mr. Davies has here missed, by the way, an opportunity of saying something original; for, oddly enough, while Cavendish, Pole, Drayson, Clay, Cœlebs, Major A., and most other writers have called attention to the advisability of refraining leading trumps when playing for the odd trick, it has not been properly pointed out that the very reason which suggests caution in leading trumps under such circumstances points to an immediate trump lead in many cases under those selfsame circumstances. I and my partner want, let us say, the odd trick to make the game, therefore the enemy want it also to save the game (or *vice versâ*). We are cautious as to leading trumps first round, lest we should fail to bring in our length and lose the chance of making a trick or two by ruffing. But after a round or two we find that by leading trumps we can deprive *the enemy* of the chance of making a trick or two by ruffing. Therefore we must lead trumps to foil them in regard to the odd trick, which is the same as saying that in such a case a trump lead is indicated as the best way to secure the odd trick. Mr. Davies tries to teach all about the lead in six short pages. This may be done by anyone who possesses some faculty for systematising, and can write succinctly and clearly. How systematic Mr. Davies is and how clear his style may be inferred from a single example. "You should lead," he says, "with Queen, Knave, and one small one, or four small ones, or the ten—the Queen, for the chance of hemming in the King." Of course, a whist-player knows what this means, but certainly the learner, for whom Mr. Davies has been kindly repeating the A B C of the game, will not make much of the rule or of the reason assigned for it; nor will the whist-player agree with Mr. Davies on either point. The lead of Queen from Queen, Knave, ten [and another, or others, usually] is simply adopted in order to establish the suit and make the best use of its strength. The lead of Queen from Queen, Knave, four small ones, is not sound whist; the fourth best card is now the accepted lead, except among those who object to the play of any but the lowest card in such cases. The lead of Queen from Queen, Knave, and a small one may serve to hem the King, as, indeed, may the other two leads of the Queen, but the object is to support partner, if he shall turn out to have strength in this short suit of fours, without giving up all command over it if it turns out to be the enemy's; for if King or Ace captures your Queen, you remain with second best guarded. In dealing with play second hand Mr. Davies ignores all recent inquiries into the advisability of covering an honour when weak in the suit. Passing on to play third hand, lead from weakness, discarding ruffing, &c., we find nothing new in Mr. Davies' teachings; but under the head "Call for Trumps" we find something very original indeed—"You may call for trumps by leading an Ace, then the King, and then a small one, or by winning the Ace and leading the King." We have heard of such nonsensical dodges at suburban clubs; and at Mr. Davies' Union Club, Birmingham, they may be excused. Indeed, by inviting Mr. Davies to publish his remarkable contribution to whist literature, the club convey the idea that such nonsense suits them. But this is emphatically not whist. We need quote only one more sample of Mr. Davies' style. He says, "When strong in trumps endeavour to establish your own long suit; when weak, your partner's." Suppose you have no good suit in the former case, and that he has none in the latter, how then? The fact is, Mr. Davies has not digested such whist experience (chiefly borrowed) as he has obtained. With such a style as his he would do well, even where he understands a subject, to leave literature alone.

Our Chess Column.

BY "MEPHISTO."

DRAWN GAMES.

ONLY a draw! This is a customary expression when honours have been equally divided between two players. The emphasis is put on the word *only*, whilst "draw" is usually pronounced with a melancholy attempt to convey an idea of the uneventful course of the game. It must not be supposed, however, that this expression of disappointment is always justified; for to draw a game requires often a great deal of exactitude, a thorough knowledge of end-games, and a considerable display of ingenuity and skill. A drawn game is also frequently brought about by the sound defence of the second player in the opening of the game. In tournaments, where draws count half, many first prizes have been lost through not being satisfied with an humble draw, and even in matches, where such games do not count, draws, especially when a player is losing, exercise a certain moral influence and slightly revive the drooping spirits. Steinitz is reported to have said, "When I drew my game at St. Louis, I found that all was not lost yet, and my hopes were revived;" at that time his score was 1 to 4.

There are different categories of drawn games. First we have the simple endings of King against King and Pawn, or King and Pawns against King and Pawns, which depend upon niceties of play by which the opposition is always maintained. Bishop against Rook is drawn, with the exception of certain unfavourable positions. The easiest way to draw is to keep the King near the corner of the same colour as the B, when the K is on Kt sq the B will always be able to interpose on B sq or Kt2. Knight against Rook is far more difficult to play. In order to draw the Kt must not separate itself from his K, as otherwise the hostile R will cut it off with the help of the K. No endings have caused more disappointments than King, Rook, and B or Kt against King and Rook: these ought to be drawn, but must be played with the utmost care, especially R against R and B. The end-games of Q against R and P are most useful; if, for instance, Black K on QR2, P on QR3 and R on QKt4 against White, K on QR4 and Q on any square, say K sq, Black will draw; but if the RP is either on R2 or R4, Black would lose. The KtP and R and the BP and R would always draw against a Queen on any square provided the K is cut off, and that there should be no necessity for the R to place himself behind his P. The P will also draw on Q2 and K2, care being taken to keep the R on K3 or B3 accordingly, and the K behind the P; but if the P is either on Q3, Q4, or K3, K4, White would win by being able to attack the K from behind, and thus force him away from his P. Draws of this kind are too numerous to be mentioned here. A very frequent draw occurs through Bishops being of opposite colours, when, in a great many cases, a Pawn more makes no difference.

Next we have draws by perpetual checks. Supposing K on KKt sq, and P's on B2, Kt2, and R3, and other pieces, then check, by the Black Q on QB8 and KB5, is a draw which occurs too often where it could be avoided. In other positions a considerable amount of ingenuity will be exercised to obtain a draw by sacrificing a piece in order to gain a perpetual check. All this should be well known in order either to guard oneself against such draws, or to obtain them as a release from a hopeless game, as in the following example:—

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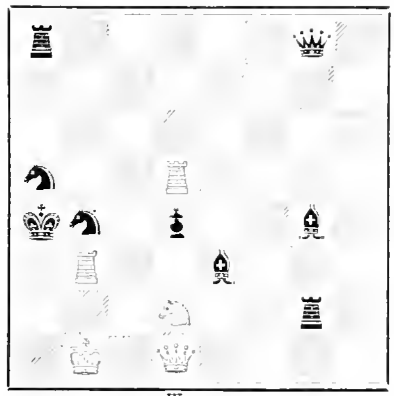

WHITE.

White will draw by 1. R to R3 (ch), K × R. 2. Q to Kt3 (ch), Kt × Q. 3. Kt to B4 (ch), K to R5. 4. Kt to Kt6 (ch) and draws by perpetual check.

Another very interesting draw is obtained by getting into a stalemate position. I cannot think of anything so gratifying to a player, and so trying to the temper of an opponent, than a stalemate. Some players look upon such a performance with a particular satisfaction, and maliciously enjoy the opponent's disappointment. In the following stalemate example we have also the perpetual check idea:—

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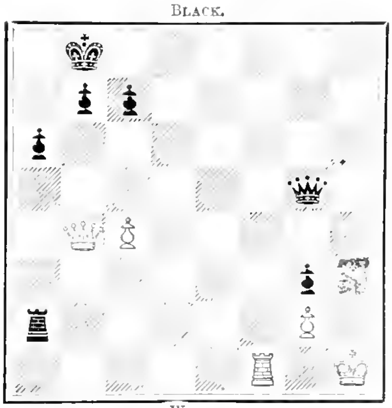


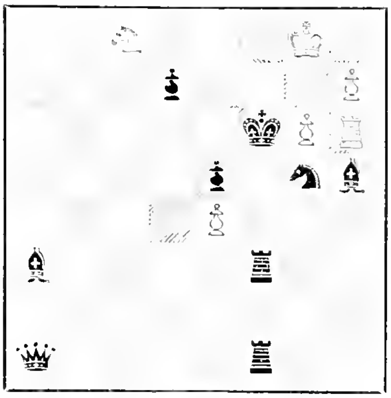
WHITE.

Stalemate follows on 1. R to B8 (ch), K to R2. 2. R to R8 (ch), K × R. 3. Q to B8 (ch), K to R2. 3. Q to B5 (ch). Q × Q. Stalemate. If Black could not take the Q, then White has the perpetual check position referred to above.

It makes a great difference very often how and when you advance a P to the 8th. Sometimes you must delay the advance in order to avoid a draw, as in the following position: White K on QR3 and P on QKt7. Black K on QR8. If White now advances his P at once to the 8th the game will be drawn, for if the P becomes Q or R, Black is stalemate, White will therefore first have to move his K. In other instances you may make a Rook by advancing, but you must not Queen it, as in the following position: White, K on QKt4 and P on QKt7; Black K on QR3. If P to Kt8 (Rook) White wins, but if P to Kt8 (Queen) it is stalemate.

Now all these examples may be much complicated by a greater surrounding of pieces; the lesson, however, should not be forgotten, as the principle equally applies. Not only is it necessary to exercise care sometimes in advancing a P to the 8th to prevent the stalemate, but it is often essential not to make a Queen or Rook, in order also to procure a stalemate, as may be seen from the following example:—

Black.



White.

White will draw by 1. P to R8 (Bishop) (ch) K to K3. 2. P to Kt7 (ch), R to B6. 3. R × R (ch), R × R, stalemate. White could not do this by making a Queen on the first move.

From these few remarks it will be seen that even only to draw a game often requires skill and ingenuity. The drawing part of the game is by no means an uninteresting feature of the game. One thing is certain, that players possessing great strength and tenacity, or others possessing less strength but more tenacity, will always draw a good many games. This is more creditable to them than the performance of the player who possesses great brilliance and enterprise, minus judgment or tenacity, who will mostly succeed in losing the same games which the other players would draw.

THE FACE OF THE SKY FOR NOVEMBER.

By F.R.A.S.

THE Sun may still be watched on every clear day (there are not many) for the spots and faculæ which, in greatly diminished size and number, occasionally appear upon his surface. The aspect of the night sky is shown in map xi. of "The Stars in their Seasons." Minima of Algol ("The Stars in their Seasons," map xii.) will happen forty-five minutes after midnight on the 13th; on the 16th, at 9h. 31m. P.M.; and on the 19th, at 6h. 23m P.M, in addition to other dates, when their observation will be difficult or impossible. The student should watch for the meteorites radiating from Leo, at and after midnight on the 13th, and for the "Andromeds" all night long on the 27th. Mercury is an evening star throughout the month—in fact, he attains his greatest elongation east of the sun (22° 29′) on the 13th, but his south declination is so great that he is practically invisible. Venus is a morning star, but is so rapidly approaching the sun, and her diameter is so small, that she is, in one sense, not much better placed for the observer than Mercury is. Mars is practically invisible, as are, during the working hours of the night, Jupiter and Uranus too; but Saturn rises before 9 P.M. at the beginning of November, and between six and seven at the end of it. He is situated some 7° to the south of Pollux ("The Stars in their Seasons," map ii.). Neptune comes into opposition to the sun on the 18th, so is capitally placed for the observer. He is about 6° south of the Pleiades, in a perfectly blank part of the sky. The Moon enters her first quarter at 5h. 5·2m. P.M. on the 3rd, and is full on the evening of the 11th at 7h. 6·5m. She enters her last quarter at 10h. 40·3m. at night on the 18th, and is new at 7h. 18·5m. P.M. on the 25th. Of a considerable number of occultations of fixed stars by the moon this month, seven only will occur at hours suitable for observation by the ordinary amateur. They are as follows. On the 3rd, B.A.C. 7263, a star of the 6th magnitude, will disappear at the moon's dark limb at 3h. 16m. P.M. at an angle of 56° from her vertex. It will reappear at her bright limb at 1h. 32m. P.M. at a vertical angle of 288°. On the 7th, 4 Ceti, a 6th magnitude star, will disappear at the dark limb at 5h. 45m. P.M. at an angle from the moon's vertex of 32°, reappearing at the bright limb at 6h. 32m. P.M. at an angle of 321° from her vertex. Later, 5 Ceti, another 6th magnitude star, will disappear at the dark limb at six o'clock at a vertical angle of 48°, and will reappear at the bright limb at 7h. 1m. P.M. at an angle of 311° from the vertex of the moon. Later still, at 6h. 23m. P.M., B.A.C. 5, also of the 6th magnitude, will disappear at the moon's dark limb at an angle of 89° from her vertex, reappearing at her bright limb at 7h. 42m. P.M., at a vertical angle of 281°. On the 9th, ν Piscium, of the 4½th magnitude, will disappear at 6h. 4m. P.M. at the dark limb, at an angle of 60° from the lunar vertex. It will reappear at 7h. 9m. P.M. at the bright limb, at an angle from her vertex of 277°. On the 12th, 48 Tauri, a 6th magnitude star, will disappear at the bright limb of the moon at 7h. 18m. P.M., at a vertical angle of 61°; reappearing at 8h. 18m. at the dark limb, at an angle of 251° from her vertex. Finally, on the same night (12th), γ Tauri, a star of the 4th magnitude, will disappear at the moon's bright limb at 9h. 17m. P.M., at an angle of 55° from her vertex; to reappear at her dark limb at 10h. 25m. P.M., at a vertical angle of 271°. When our notes begin, the Moon is in Sagittarius ("The Seasons Pictured," plate xxi.), through which she is travelling, until 6 P.M. on the 2nd, when she enters Capricornus. It takes her until 4 P.M. on the 3rd to cross the constellation last named, and then she passes into Aquarius. She does not leave Aquarius until midnight on the 6th, at which hour she crosses the boundary into Pisces ("The Seasons Pictured," plate xxii.). She is travelling through this great straggling constellation until 4 A.M. on the 10th, when she arrives at the north-eastern corner of Cetus. She has passed over this by 6 o'clock the same evening and entered Aries. She remains in Aries until 9h. 30m. P.M. on the 11th, and then passes over the boundary into Taurus ("The Seasons Pictured," plate xxiii.). Travelling through Taurus, she arrives at 2h. 30m. P.M. on the 14th at the narrow northern strip of Orion. By 2h. 30m. the next morning she has traversed this and emerged in Gemini ("The Seasons Pictured," plate xxiv.). She remains in Gemini until 6h. 30m. P.M. on the 16th, when she enters Cancer. She quits Cancer for Leo at 6h. 30m. A.M. on the 18th, and Leo in turn for Virgo at 7 P.M. on the 20th ("The Seasons Pictured," plate xxv.). Her journey across Virgo is not finished until 6 P.M. on the 23rd, when she enters Libra ("The Seasons Pictured," plate xxvi.). At 1h. 30m. P.M., on the 25th, she reaches the narrow northern pointed part of Scorpio. Over this she has passed by 10h. 30m. the same night and entered Ophiuchus. This she quits for Sagittarius at 4 P.M. on the 27th. At 2 A.M. on the 30th she enters Capricornus ("The Seasons Pictured," plate xxi.). She is still in Capricornus at midnight.

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THE CLOUDBERRY.

I WONDER whether I need begin by telling the English reader that Mount Washington is the highest peak of the White Mountain range in New Hampshire, and practically the most elevated summit along the entire Atlantic slope of America, its only rival in this respect being some remote and inland Carolinian hills, unknown to fame and unvisited by the gregarious Transatlantic tourist? We had a splendid day for our easy ascent by the steep little railway on the Rigi pattern, with middle cog-wheel and oblique engine, which puffs and toils up the abrupt gradients; and when we reached the top, though the clouds were swirling and wreathing around us, the view was magnificent, and the morning clear as heart could wish it. As soon as we had drunk our fill of the prospect, however, we turned of course to our more proper and professional task of botanising; and the very first plant that attracted my attention, wedged in among the crannies of the huge boulders that strew the summit, as chance would have it, was an overblown cloudberry. I took it up and gazed at the northern herb with a certain fond and reverent attention, for it was the first cloudberry I had ever seen in the living state, though I knew its form and features well enough already from frequent illustrations, and from herbarium specimens. But it was quite another thing to pick that curious Arctic plant here among its own chilly native surroundings, and to recognise in it a last lingering relic of the glacial epoch on the top of Mount Washington.

Of course you remember the pictures of the cloudberry in all the books of Arctic exploration. There is a very good one in Nordenskiöld's "Voyage of the *Vega*," for the cloudberry is the great stand-by of the Polar voyager as a fresh fruit and preservative against scurvy. No other edible berry grows so far north among the ice and snow; no other can so readily be obtained by northern sailors in their last port as this dwarf representative of the bramble genus. But besides its importance as an article of food in high latitudes, the cloudberry has a deep scientific interest as well as a typical specimen of the glacial flora which came in with the approach of the Great Ice Age. No other herb could more admirably illustrate from a certain side the striking traits of the Arctic vegetation, and the peculiar way in which it has been modified in order to meet the needs of a chilly climate.

The cloudberry, indeed, is a true circumpolar type of plant, found in turfy bogs, tundras, and peat mosses, all round the Arctic circle, in Europe, Asia, and America alike. In the extreme north—in Siberia, Finland, Norway, and British North America—it is a lowland plant, inhabiting the wide water-logged plains with which those sub-arctic lands are so thickly covered. But as it ranges southward it clings rather to the upland bogs, the wet places on the mountain sides, and the moist crannies of the rocks and boulders that strew their summits. Generally a high northern herb, it descends towards the summer sun in Europe along the Baltic shore into the heart of Germany; and it occurs abundantly among the combes and hollows of the Scotch Highlands, as well as less frequently in the wet moorlands of Yorkshire, Donegal, and even North Wales. I might easily, therefore, have seen the cloudberry on our own side of the Atlantic, had I been there to look for it, without taking the trouble of going to America to hunt it up: but it takes a lifetime for a man to make personal acquaintance with all the plants even of our limited little British flora in their native haunts; and, as a matter of fact, I had never before seen a cloudberry "all a-growing and a-blowing," as the costermongers say, till I picked it that day on the summit of Mount Washington. And, indeed, I was not sorry that I should have caught my first glimpse of this Arctic strayling in such a sublime and congenial situation.

And now, at last, what *is* the cloudberry? It is a little, green, herbaceous bramble, with no woody stem, no trailing branches, no stout armour of defensive prickles—a mere succulent herb, low and inconspicuous, seldom rising more than three or four inches above the frostbound ground—in short, a blackberry bush reduced by cold to the abject condition of a wild strawberry vine. Like many other Arctic and mountain plants, its rootstock creeps under ground, so as to avoid being frozen during the chill winters of its chosen habitat; and here and there it sends up short herbaceous stems, wholly unarmed, and bearing at best only two or three round or kidney-shaped leaves, somewhat toothed at the edge, and often cut into from five to nine broad lobes or divisions. The flowers are large and white, as so frequently happens with northern or upland plants, and they are far prettier and more conspicuous than our English raspberry or blackberry blossoms, so as to attract the short-lived northern butterflies, by whose aid the blossoms are probably always fertilised. Self-fertilisation, indeed, is efficiently guarded against in this instance by the flowers having become specialised each to a single sex. One plant will bear, however, blossoms with stamens only, and no pistil or fruit; another will have fertile flowers with pistils only, and no stamens to supply them with pollen. In this way the benefits of cross-fertilisation are rendered obligatory, so that insect visits become a matter of prime necessity to the existence of the plant. The fruit, when ripe, is rather large, of the raspberry type, but consisting of a few big grains only. In fine, it is a delicate amber colour, or sometimes almost orange-red; and the flavour, though agreeably acid, is pleasant and tasty. Altogether, a distinct boon to the northern traveller, this inconspicuous reduced little bramble.

In origin, the cloudberry must be regarded as a Polar plant of the period immediately preceding the Great Ice Age; and it owes its development to the immense though gradual lowering of the Arctic temperature which preceded that long, slow, secular cataclysm. The bramble genus, to which the cloudberry belongs, falls naturally into two main groups, the blackberries and the raspberries, as we call them in the vernacular, from the two representatives best known in actual practice to non-botanical British humanity. The great distinguishing mark between them lies not in the colour (for some American blackberries are bright red, if I may be forgiven so obvious a bull, while the common black raspberry of the Northern States looks a good deal blacker than the English blackberry itself), but in the way in which the fruit behaves when separated from the "hull," "hank," or receptacle. With the true raspberries, as everybody knows, the fruit comes off entire like a thimble, leaving a hollow in the centre where the hull used to be. In the true blackberries, on the other hand, the fruit adheres tightly to the hull, which has to be broken off and eaten with it. Of these two types, the cloudberry belongs to the first or raspberry group, as do also our common red raspberries, the American black raspberry, the purple-flowering raspberry, and the Nutka bramble of our shrubberies and gardens. The English blackberries and dewberries, on the other hand, as well as the numerous American black and red blackberries, belong rather to the second or true bramble class.

The brambles must already have existed abundantly in the world long before the Glacial Epoch, because we find several representatives of both groups in Europe and America, some of them nearly identical on both sides of the Atlantic, and others widely different in character and aspect. They were then already bushy plants, armed for the most part with stout prickles, and divided into many of their existing species, though a few have since diverged independently, such as the wild red raspberry of America, which, though closely resembling our European type, is now adjudged to be specifically distinct in certain minor technical peculiarities. Time has sufficed to work the change under diverse conditions. But there could be as yet no cloudberries, because there were as yet none of the Arctic or snowy-mountain conditions under which alone the cloudberry flourishes. The herbaceous brambles are all northern and cold-weather species, and they could not possibly have come into existence before the Glacial Epoch made the proper habitats of such species possible. If you look into such a book as Professor Babington's "Manual of British Botany" (written without regard to evolutionary principles) you will find the main division of the brambles made into—A. Shrubby, and B. Herbaceous brambles; the raspberry and blackberry being classed under the first, and the cloudberry and stone-bramble under the second heading. But a moment's consideration will show you that this is not a point of classificatory or hereditary importance at all: it is a mere point of adaptive modification. The real division of the ancestral type, long before the Glacial Epoch, during the warm Pliocene or Miocene times, was the one I have given above, into "thimbleberries" and "stickberries;" and the modern Arctic cloudberries, and so forth, are mere stunted and herbaceous developments of the original raspberry or thimbleberry group. Any one who will take the trouble to look at the distribution of the species at the present day will see that this must be so.

We have in England a plant which shows in a less degree the peculiar dwarfing effect of the Glacial Epoch on the bramble type; I mean the little stone-bramble of the northern shires, whose creeping rootstock sends out a few unobtrusive runners and almost herbaceous stems, which rise, however, far higher than those of the cloudberry, often to as much as a foot from the ground. These stems are slender and downy, and armed with a few soft prickles, the last dwindling abortive representatives of the brambly hooks of our hedge blackberry. Now the stone-bramble is clearly a dwarfed form, which has felt the effect of the northern winter, but has been less deeply impressed by its dwindling effects than the cloudberry itself. It is, in fact, a somewhat more southern though upland type, diffused over all the mountain regions of Europe and Central Asia, and not by any means so distinctly circumpolar as the more decidedly herbaceous forms. Similarly, in America they have a little plant, the dwarf raspberry, which I found abundantly among the valleys of the White Mountain range, whose stems are annual, low, herbaceous, and devoid of prickles, but with three leaflets to each stalk, instead of a simple leaf like the cloudberry's, and with a blossom more like that of the garden raspberry. This intermediate form descends as far south as Pennsylvania, and has not felt the glacial dwarfing nearly so much as the far northern species.

For fear of misapprehension, I ought distinctly to add that I do not consider any of these half-herbaceous raspberries as really halfway houses between the cloudberry and its original Pliocene ancestor. They are rather independent species, which have undergone to a less extent the same sort of dwarfing from the same cold-weather causes. Just in like manner the Glacial Epoch developed the tiny northern herbaceous willow out of the tree-like willows of Pliocene times; and it turned the birch into that queer little, stunted, span-high form which we still find in Arctic climates, and whose relics occur in the glacial leaf-beds. The immediate ancestor of the cloudberry, indeed, must have been a bushy raspberry answering closely in type to the Nutka bramble, which, though shrubby, has no prickles, and agrees with the cloudberry in its simple leaves and large white flowers, as well as in the broad flat form of its depressed fruit. Indeed, the cloudberry still bears on its very face one mark of having ultimately descended from such an ancestor, because, though it now produces only two or three leaves on each stem, the base of the stem is covered with a mass of empty stipules (or winged leaf-stalks, to talk popularly), which recall the memory of a time when the stem was much taller than now, and produced an immense number of leaves. The botanical reader will know what I mean when I say that the internodes between these stipules remain undeveloped in consequence of the great dwarfing of the stem and suppression of the accompanying leaves. The stipules themselves, in short, are the outward and visible sign of the derivation of the cloudberry from a once much larger and taller bramble.

The Arctic raspberry, on the other hand, said (though no doubt erroneously) to have been gathered on the Isle of Mull, and common in high latitudes in Europe, is a dwarfed herbaceous descendant of a pink-flowered species with three leaflets to each leaf, akin in all probability to the dwarf raspberry of the Northern States. In short, when the Glacial Epoch came on, it reduced to Arctic scrubbiness all the plants that could accommodate themselves to the altered circumstances; and hence the dwarf herbaceous habit is really no test of descent or relationship at all, but a mere result of the chilly conditions under which the species now live.

One word as to the occurrence of the cloudberry on the summit of Mount Washington at the present day. During the period of the greatest glacial extension this little plant, with hundreds of other Arctic species, was driven down far into the central lowlands of America, where they all flourished together until the ice began to retreat again. When the glacial sheet retired northward, however, the Arctic plants retired with it; but a few of them were left, above the limit of trees, on the chilly tops of the White Mountains. That is almost the only station for the cloudberry in the United States; but in the extreme north—at Lubeck, in Maine—it reappears upon the sea-coast, and thence it extends through frozen Nova Scotia, and still more frozen Labrador, till it reaches at length the Arctic circle. Like a living fossil, it recalls to us still on these wind-swept New Hampshire heights the long secular winter of the glacial period.

THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

By Edward Clodd.

PART II.—EXPLANATORY.

Chapter I.

It must be so, for miracles are ceased:
And therefore we must needs admit the means
How things are perfected.
Archbishop of Canterbury: *Henry V*, act i., scene 2.

The gases gather to the solid firmament; the chemic lump arrives at the plant and grows: arrives at the quadruped and walks: arrives at the man and thinks.—Emerson.

In the second paper of this series a summary account was given of the materials which make up the Universe.* These were comprised under the terms Matter and Power. Power is that which acts upon Matter in the production or destruction, the increase or decrease of motion: and, as explained already, it is upon this two-fold and opposite action that we base our assumptions as to the nature of Matter—*i.e.* as consisting of atoms of infinite minuteness.

That form of Power which draws the atoms together into larger or smaller masses, and which resists their separation, we call Force; that form of Power which drives the atoms apart and resists their combination, we call Energy. Both Force and Energy are, like Matter, indestructible; in other words, the sum-total of each is a fixed quantity. Force inheres in, and cannot be taken from, each atom of weighable matter; but Energy passes from atom to atom and from mass to mass, its vehicle being that unweighable ethereal medium which is supposed to fill the spaces between bodies and between the particles of bodies. In this diverse way each is ceaselessly acting: Force aggregating the particles round various centres, Energy separating them and passing into space, only fractions of it striking intervening bodies, as, *e.g.*, in the interception of the sun's radiant energy by the planets. And the certain result, however immeasurably distant, is that all the Energy of the Universe will be dissipated, and that all the Matter of the Universe will become cold, solid, and inert under the aggregating and unopposed action of Force.

The problem we have now to consider is this:—Given Matter and Power as the raw materials of the Universe; is the interaction of Power, under its two forms of a combining Force and a separating Energy, upon Matter, sufficient to account for the totality of non-living and living contents of the Universe?

Of the beginning, of what was before the present state of things, of what will follow the end of it, we know nothing, and speculation about it is futile. Science is concerned with the Universe as we find it, the mobile vehicle of orderly succession; the Evolved, or Unfolded; *das Werden*, as the Germans say, or the Becoming; not less full of endless significance because the questions of its origin and destiny are without answer; not less wrapped in mystery as to its ultimate nature because we describe it as a mechanical process, and do not fall back upon unknown agencies or assume unknown attributes of Matter or Power to explain it.

But since everything points to the finite duration of the material universe—for what it now is it once was not, and its state is ever changing—we must make a start somewhere. And we are therefore compelled to posit a primordial nebulous, non-luminous state, when the atoms, with their inherent forces and energies, stood apart from one another in momentary pause. Not evenly distributed, else Force would have drawn them together as an uniform spherical mass round a common centre of gravity, and Energy, awakened by the collision of atom with atom, would have passed profitlessly in the form of heat to the ethereal medium; but varying in position and character, with special gravitation towards special centres. This theory of unstableness and unlikeness at the outset squares with the unequal distribution of Matter, with the movements of its masses in different directions and at different rates, and with the ceaseless redistribution of Matter and Power. All changes of state are due to the rearrangement of atoms through the play of attracting forces and repelling energies, resulting in the evolution of the seeming like into the actual unlike, of the shapeless into the shapely, of the simple into the more and more complex, till the highest complexity is reached in the development of living matter. If all that is, from fire-fused rock to the genius of man, was wrapped up in primordial matter, with its forces and energies, we can speak of simplicity only in a relative sense as contrasted with the infinite variety around us which has been evolved.

Inorganic Evolution.—Under this head we may apply the foregoing to the earliest stages of cosmical change, to the *Evolution of Stellar Systems.*

The existence of nebulous or cloud-like objects in space, which the telescope, aided by the analysis of the spectroscope, proves to be immense masses of glowing gas, together with other evidence to be duly cited in its place, justifies the assumption of a yet more discrete state of the atoms which formed the material universe at the outset. But, although we are familiar with matter in an invisible state, as, *e.g.*, in the element oxygen, which, in a combined state, forms nearly half the solid framework of the globe, we can form no conception of the extreme rarefaction of the primitive atoms. Upon this Helmholtz remarks that "if we calculate the density of the mass of our planetary system at the time when it was a nebulous sphere which reached to the path of the outermost planet, we should find that it would require several millions of cubic miles of such matter to weigh a single grain." Given, however, the play of Force and Energy upon this diffused matter, the mechanics of the process which resulted in the visible universe are not difficult of explanation. The Force bound up in each atom, acting as affinity, combined the atoms as molecules; acting as cohesion, it united the molecules into masses; acting as gravitation, it drew the masses toward their several centres of gravity. One of these masses, by no means the largest, became the nucleus of our solar system, which may be taken as a type of all other masses whose evolution into stellar systems is as yet complete.

As the atoms rushed together, Energy, which had hitherto existed in a state of rest as passive separation, became active in *molar* and *molecular* form. As *molar* energy it imparted motion to each mass, a motion of rotation on its own axis; and a motion in an orbit, as in the proper motion of double stars, and of the planets round the sun. As *molecular* energy it imparted a rapid vibratory backwards and forwards motion to the molecules, which motion was forthwith converted into the radiant energy of heat and light, rendering the mass self-luminous. From the moment of their conversion the dissipation of both forms of energy ensued. The friction of the ethereal medium slowly retards the orbital motion of every mass, the molar energy thus lost passing into that medium, until finally the movement in the orbit will be stopped, and the force of gravitation, no longer resisted by energy, will draw the smaller masses to the larger, as vagrant meteors are being ceaselessly drawn to planets

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* Knowledge, December 1885, p. 41. The reader will find the present explanation easier to follow if he will read the whole of chap. ii. in Part I. again.

and sun. Moons will gravitate to their planets, planets to their suns, and so on, until the matter of the universe, with intermediate outbursts of energy, becomes cold, inert, and solid, and Force will have subdued all things unto itself. The molecular energy likewise passes, but more rapidly, into the ethereal medium, throbbing ceaselessly in all directions to the farthest marge of space, if any marge there be. Small portions of it are intercepted by each mass, but of these the larger proportion is reflected back, the remainder setting up separative motions on the surface, as, *e.g.*, in the familiar case of the action of the sun's radiant heat on the earth. Of this solar energy, which is radiated equally in every direction, the earth does not intercept much more than the two thousand millionth part. And of this the larger proportion is reflected back, only a fraction, to be itself finally dissipated, being used to maintain the earth as the theatre of changes whose highest result is life.

Such, with much detail left out for clearer presentment of the subject, is the mode in which the shining hosts of stellar systems, as the sand by the sea-shore innumerable, appear to have been evolved from nebulous matter. In this exposition students of astronomy will recognise the "nebular theory" of Kant and Laplace, but with important modifications due to the doctrine of the Conservation of Energy, which was unknown in their day.*

Evolution of the Solar System.—We may now leave the general for the particular, and apply the theory to the evolution of the stellar system to which we belong, and to that portion of it which we call our earth. If the explanation of the origin of the sun and planets repeats somewhat of the foregoing, it will only bring home to us the uniformity of the process, and show that what is true of the whole holds good for every part, and for the parts of every part down to the indivisible and unseen atoms of which all things consist.

Two striking pieces of evidence of the common origin of the sun and planets may be cited at the outset:—(1) They are made of like materials; (2) they have like motions.

1. The spectroscope has revealed to us the chemical constitution of several of the fixed stars, their enormous distance not affecting the trustworthiness of the analysis. It evidences to the existence of substances in the glowing vapours of their atmospheres akin to those which feed the fires of the sun; and if such identity of stuff is proved to exist between the sun and other stars, we may with reason look for still closer identities of material between him and his family of planets, moons, and erratic bodies.

2. The planets and, with rare exceptions, their satellites, revolve round him in the same direction; they also, so far as is known, rotate on their axes in the same direction, and very nearly coincide in the shape and planes of their orbits, which are almost in a plane with the sun's equator. Now, since the consequences would be the same were these motions, both on axis and in orbit, in the reverse direction, the inference is obvious that there was an uniform motion of rotation of the mass from which they were severally formed.

As with the primitive nebula from which that mass was detached, so with the mass itself; there were differences of density throughout. On no other theory is its segregation into a multitude of bodies explicable. As the rotation of the mass quickened with the indrawing of the particles towards the common centre of gravity, the energy of molar separation acted most powerfully in the region of the bulging equator, and, overcoming the force of cohesion along the line of least resistance, detached certain portions one after another at irregular intervals from the central mass as it retreated within itself. These portions were the nuclei of the planetary groups, in which the like processes of contraction and rupture were repeated, the masses detached becoming moons, or, as in the case of Saturn, rings of satellites. In respect of the diffused and highly energised fugitive masses, as comets and meteors, Mr. Proctor has adduced cogent reasons in support of the theory that they are "products of expulsion from suns, from giant planets, and from orbs like our earth when in the sun-like state."

The origin of the planets and their moons being found in the mode described above, it is obvious that in their primitive state they were molten, and shone by their own light. The smaller the body, the sooner would its molecular energy be dissipated; in other words, the quicker it lost its heat. The present in a large degree interprets the past, and explains the several stages of the members of our system, according to their bulk. The sun, whose mass exceeds the combined mass of all the planets more than 700 times, is still slowly contracting, and therefore still radiating energy. The cloud-laden atmospheres of the larger planets, as Jupiter and Saturn, are torn by cyclones only second to those of the sun in their fury, and the molten centres feed volcanic outbursts to which those of Vesuvius and Krakatoa are squibs. But as for the smaller bodies, their turmoil is calmed and their light extinguished; the store of energy is exhausted; the forces of affinity and cohesion have gained the upper hand and drawn the particles together into the solid form. Thus it is with the moon, on whose dead and barren surface we may read the future of the giant planets and the sun himself. For the history of one is the history of all; each has passed, or is passing, from the indefinite nebulous state, through numberless modifications, to the definite and solid state; by decrease in volume and increase in density. What the earth is, the moon was; what the moon is, the earth will be.

Evolution of the Earth.—To this passage from the sun-like to the solid state the earth bears witness. Its flattened poles, its bulging equator, its spheroidal shape, are the effects of rotation on a fluid or viscous mass; whilst the geologically oldest parts of the crust—for there is no primogeniture in matter—are of a structure which is producible only by the fusion of particles under intense heat. As that crust, thin and mobile at the outset, continued to cool and thicken, it evidenced more strikingly to the play of forces and energies within and of energies, and, in lesser degree, of forces without. The cooling and shrinking of the internal mass, as the stored-up energy slipped away, caused tension of the crust, which, yielding to the force of gravitation, was drawn inwards, and cracked and crumpled into mountains and valleys, and into the deep depressions which the great oceans have filled since the time when their waters were first condensed from the thick primitive vapours that swathed the cooling earth. Then the continuous action of the sun's radiant energy, operating through air and water upon the increasingly rigid crust, dissolved its superficial particles, and re-deposited them as stratified rocks, in endless beauty and variety, over the surface of the globe. And herein lies the major cause of our earth's present condition as a possible abode of life. For its native supply of energy—that of position derived from the momentum given it when thrown off from the parent mass; and the still unspent, but always lessening, store of internal heat manifest in the volcano and the earthquake—would not suffice to arrest effeteness and the wrapping of the globe in a winding-sheet of ice. It is the imported supply from the sun which alone does that, for in its absence the trivial tidal energy due to the moon would

* For a lucid criticism of the defects of Laplace's theory, more especially in its failure to account for the peculiar distribution of the larger and smaller planets, the reader may study with advantage Mr. Proctor's essay on "How the Planets Grew" in his "Expanse of Heaven."

be futile, because the seas and oceans would be solid. Opposing the force which attracts everything into inert union, the solar energy sets up the separative motions, the ceaseless redistributions, which give rise to the grand climatal and vital phenomena of nature. Expanding the air, it causes the inrush to which winds and storms are due; heating the water, it excites the warm currents and draws heavenward the aqueous vapour, which, driven by the wind, returns, when its energy is lost, as rain and snow, those silent yet mightiest agents of mechanical, chemical, and vital changes. But the full significance of the work done by the sunbeams that strike the earth's surface will appear when we treat of the relation of the living to the not-living.

MARTINGALES;

Or, SURE (?) GAMBLING SYSTEMS.

IN previous pages I have considered, under the head of "Gamblers' Fallacies," certain plans by which some fondly imagine that fortune may be forced. I have shown how illusory the schemes really are which at first view appear so promising. There are other plans the fallacy in which cannot be quite so readily seen, though in reality unmistakable, when once the conditions of the problem are duly considered.

Let me in the first place briefly run through the reasoning relating to one of the simpler methods already considered at length.

The simplest method for winning constantly at any such game as *rouge et noir* is as follows:—The player stakes the sum which he desires to win, say 1*l.* Either he wins or loses. If he wins he again stakes 1*l.*, having already gained one. If, however, he loses, he stakes 2*l.* If this time he wins, he gains a balance of 1*l.*, and begins again, staking 1*l.*, having already won 1*l.* If, however, he loses the stake of 2*l.*, or 3*l.* in all (for 1*l.* was lost at the first trial), he stakes 4*l.* If he wins at this third trial, he is 1*l.* to the good, and begins again, staking 1*l.* after having already won 1*l.* If, however, he loses, he stakes 8*l.* It will readily be seen that by going on in this way the player always wins 1*l.* when at last the right colour appears. He then, in every case, puts by the 1*l.* gained and begins again.

It seems then at first as though all the player has to do is to keep on patiently in this way, starting always with some small sum which he desires to win at each trial, doubling the stake after each loss, when he pockets the amount of his first stake and begins again. At each trial the same sum seems certainly to be gained, for he cannot go on losing for ever. So that he may keep on adding pound to pound, *ad infinitum*, or until the "bank" tires of the losing game.

The fallacy consists in the assumption that he cannot always lose. It is true that theoretically a time must always come when the right colour wins. But the player has to keep on doubling his stake practically, not theoretically; and the right colour may not appear till his pockets are cleared. Theoretically, too, it is certain that be the sum at his command ever so large, and the stake the bank allows ever so great, the player will be ruined at last at this game, if—which is always the case—the sum at the command of the bank is very much larger. It would be so even if the bank allowed itself no advantage in the game, whereas we know that there is a certain seemingly small, but in reality decisive, advantage in favour of the bank at every trial. Apart from this, however, the longest pocket is bound to win in the long run at the game of speculation which I have described. For, though it seems a tolerably sure game, it is in reality purely speculative. At every trial there is an enormous probability in favour of the player winning a certain insignificant sum; but, *per contra*, there is a certain small probability that he will lose, not a small sum, or even a large sum, but all that he possesses—supposing, that is, that he continues the game with steady courage up to that final doubling which closes his gambling career, and also supposing that the bank allows the doubling to continue far enough; if the bank does not, then the last sum staked within the bank limit is the amount lost by the player, and, though he may not be absolutely ruined, he loses at one fell swoop a sum very much larger than that insignificant amount which is all he can win at each trial.

Although this gambling superstition has misled many, yet after all it is easily shown to be a fallacy. It is too simple to mislead any reasonable person long. And indeed, when it has been tried, we find that the unfortunate victim of the delusion very soon wakes to the fact that his stakes increase dangerously fast. When it comes to the fifth or sixth doubling, he is apt to lose heart, fearing that the luck which has gone against him five times in succession may go against him five times more, which would mean that the stake already multiplied 32 times would be increased, not 32 times, but 32 times 32 times, or 1,024 times, which would either mean ruin or a sudden foreclosure on the bank's part and the collapse of the system.

For the benefit of those who too readily see through a simple scheme such as this, gamblers have invented other devices for their own or others' destruction, devices in which the fallacy underlying all such plans is so carefully hidden that it cannot very readily be detected.

The following is a martingale (as gamblers call these devices for preventing fortune from rearing against them) which has misled many:—

The gambler* first decides on the amount which he is to win at each venture—if that can be called a venture which according to his scheme is to be regarded as an absolute certainty. Let us say that the sum to be won is 10*l.* He divides this up into any convenient number of parts, say three; and say that the three sums making up 10*l.* are 3*l.*, 3*l.*, and 4*l.* Then he prepares a card on the annexed plan (fig. 1), where W stands for winnings, L for losses, and M (for martingale) heads the working column which guides the gambler in his successive ventures.

W	M	L
	£3	
	3	
	4	

Fig. 1.

The first part of the play is light and fanciful: the player—whom we will call A—stakes any small sums he pleases until he loses, making no account of any winnings which may precede his first loss. This first loss starts his actual operations. Say the first loss amounts to 2*l.*: A enters this sum in the third column (see fig. 2) as a loss, and also in the second under the cross-line. He then stakes the sum of this number, 2, which is now the lowest in column M, and 3, the uppermost—that is, he stakes 5*l.* If he loses, he enters the lost 5*l.* in columns M and L; and next stakes 8*l.*, the sum of the top and bottom figures (3*l.* and 5*l.*) in column M. He goes on thus till he wins, when he enters under the head W the amount he has won, and scores out in column M the top and bottom figures—viz., the 3*l.* (at the top), and the last loss (at the bottom). This process is to be continued, the last stake, if it be lost, being always scored at the bottom of column M, as well as in the loss column, the last win being always followed by the scoring out of the top and

* The account of the system here considered appeared in the *Cornhill Magazine* under the heading "A San Carlo Superstition," and was in that place described as "a pretty little martingale" recently submitted to me by a correspondent of Knowledge.

bottom remaining numbers in column M. When this process has continued until all the numbers in column M are scored out, A will be found to have won 10*l.*; and whatever the sum he had set himself to win in the first instance, so long as it lies well within the tolerably wide limits allowed by the bank, A will always win just this sum in each operation.

Let us take a few illustrative cases, for in these matters an abstract description can never be so clear as the account of some actual case.

Consider, then, the accompanying account by A of one of these little operations. The amount which A sets out to win is, as before, 10*l.* He divides this up into three parts—3*l.*, 3*l.*, and 4*l.* He starts with a loss of 2*l.*, which he sets in columns M and L. He stakes next 5*l.* and loses, setting down 5*l.* in columns M and L. He stakes 8*l.*, the sum of the top and bottom numbers in column M, and wins. He therefore sets 8*l.* under W, and scores out 3*l.* and 5*l.*, the top and bottom numbers in column M. (The reader should here score out these numbers in pencil.) The top and bottom numbers now remaining are 3*l.* and 2*l.* Therefore A stakes now 5*l.* Say he loses. He therefore sets down 5*l.* both in column M and column L, and stakes 8*l.*, the sum of the top and bottom numbers under M. Say he loses again. He, therefore, puts down 8*l.* under columns M and L, and stakes 11*l.*, the sum of the top and bottom numbers under M. Say he wins. He puts down 11*l.* under W, and scores out the 3*l.* left at the top and the 8*l.* left at the bottom of the column under M. (This the reader should do in pencil.) He then stakes 9*l.*, the sum of the top and bottom numbers (4*l.* and 5*l.* respectively) left under M. Say he wins again. He then puts down 9*l.* under W, and scores out the 4*l.* left at the top and the 5*l.* left at the bottom of the column under M. There now remains only one number under M, namely, 2*l.*, and therefore A stakes 2*l.* Let us suppose that he loses. He puts down 2*l.* under M and L, and, following the simple rule, stakes 4*l.* Say he wins. He then puts down 4*l.* under W, and scores out 2*l.* and 2*l.*, the only two remaining numbers under M. A, therefore, now closes his little account, finding himself the winner of 8*l.*, 11*l.*, 9*l.*, and 4*l.*, or 32*l.* in all, and the loser of 2*l.*, 5*l.*, 5*l.*, 8*l.*, and 2*l.*, or 22*l.* in all, the balance in his favour being 10*l.*, the sum he set forth to win.

W	M	L
	£3	
	3	
	4	
	2	£2
	5	5
£8	5	5
11	8	8
9	2	2
4		
£32		£22

Fig. 2.

It seems obvious that the repetition of such a process as this, any convenient number of times at each sitting, must result in putting into A's pocket a considerable number of the sums of money dealt with at each trial. In fact, it seems at a first view that here is a means of obtaining untold wealth, or at least of ruining any number of gambling banks.

Again, at a first view, this method seems in all respects an immense improvement on the simpler one. For whereas in the latter only a small sum can be gained at each trial, while the sum staked increases after each failure in geometrical progression, in this second method (though it is equally a gambling superstition) a large sum may be gained at each trial, and the stakes only increase in arithmetical progression in each series of failures.

The comparison between the two plans comes out best when we take the sum to be won undivided, when also the system is simpler; and, further, the fallacy which underlies this, like *every* system for gaining money with certainty, is more readily detected, when we consider it thus.

Take, then, the sum of 10*l.*, and suppose 5*l.* the first loss, after which take two losses, one gain, one loss, and two gains. The table will be drawn up then as shown—with the balance of 10*l.*, according to the fatal success of this system.

W	M	L
	£10	
	5	£5
	15	15
	25	25
£35	20	20
25		
15		
£75		£65

On the other hand, take the other and simpler method, where we double the original stake after each failure. Then supposing the losses and gains to follow in the same succession as in the case just considered, note that the first gain closes the cycle. The table has the following simple form (counting three losses to begin with):—

W	L
	£10
	20
£80	40
£80	£70

We see then at once the advantage in the simpler plan which counterbalances the chief disadvantage mentioned above. This disadvantage, the rapid increase of the sum staked, is undoubtedly serious; but, on the other hand, there is the important advantage that at the first success the sum originally staked is won; whereas, according to the other plan, every failure puts a step between the player and final success. It can readily be shown that this disadvantage in the less simple plan just balances the disadvantage in the simpler plan.

But now let us more particularly consider the probabilities for and against the player involved in the plan we are dealing with.

Note in the first place that the player works down the column under M from the top and bottom, taking off two figures at each success, and each figure adding one figure at the bottom after each failure. To get then the number of figures scored out we must double the number of successes; to get the number added we take simply the number of failures, and the total number of sums under M is therefore the original number set under M, increased by the number of failures. He will therefore wipe out, as it were, the whole column, so soon as twice the number of successes either equals or exceeds by one the number of failures (including the first which starts the cycle). Manifestly the former sum will equal the latter, when the last win removes two numbers under M, and will exceed the latter by one when the last win removes only one number under M.

Underlying, then, the belief that this method is a certain way of increasing the gambler's store, there is the assumption that in the long run twice the number of successes will equal the number of failures, together with the number of sums originally placed under M, or with this number increased by unity. And this belief is sound; for according to the doctrine of probabilities, the number of successes —if the chances are originally equal—will in the long run differ from the number of failures by a number which, though it may perchance be great in itself, will certainly be very small compared with the total number of trials. So that twice the number of successes will differ very little relatively from *twice* the number of failures, when both numbers are large; and all that is required for our gambler's success is that twice the number of successes should equal *once* the number of failures, together with a *small* number, viz. the number of sums originally set under M, or this number increased by unity. So that we may say the gambler is practically certain to win in the long run in any given trial.

In this respect the method we are now considering resembles the gambling superstition before examined. In that case also the gambler is sure to win in the long run, as he requires but a single success to wipe out the losses resulting from any number of failures. He is in that case sure to succeed very much sooner (on the average of a great number of trials) than in the latter.

But we remember that even in that case where success seems so assured, and where success in the long run—*granting the long run*—is absolutely certain, the system steadily followed out means not success but ruin. No matter what the limit which the bank rules may assign to the increase of the stakes, so long as there *is* a limit, and so long as the bank has a practically limitless control of money as compared with the player, he must eventually lose all that he possesses.

Hence we cannot assume that, because the method we are considering insures success in the long run, the gambler can win to any extent when the long run is not assured to him. Here lies the fallacy in this, as in all other methods, of binding fortune to the gambler's wheel. The player finds that he must win in the long run, and he never stops to inquire what run is actually allowed him. It may be a short run, or a fair run, or even a tolerably long run; but the question for him is, will it be long enough? And note that it is not only the limitation which the bank may assign to the stakes which we have to consider: the gambler's possessions assign a limit, even though the bank may assign none.

Let us see, then, what prospect there is that in this, as in the other case, a run of bad luck may ruin the player—or rather, let us see whether it be the case that in this, as in the other system, patient perseverance in the system may not mean certain ruin, which ruin may indeed arrive at the very beginning of the confident gambler's career.

Instead of all but certainty of success in each single trial which exists in the simpler case, there is in the case we are considering but a high degree of probability. It is very much more likely than not that in a given trial the gambler will clear the stake which he has set himself to win. (This is why we so often hear strong expressions of faith in these systems: again and again we are told with open-mouthed expressions of wonder that a system of this sort must be infallible, because, says the narrator, I saw it tried over and over again, and always with success.) Granted that it is so; indeed, it would be a poor system which did not give the gambler an excellent chance of winning a small stake, in return for the risk, by no means evanescent, that he may lose a very large one.

Observe, now, how the chances for and against are balanced between the two systems. Suppose such a run of ill-luck as in the simpler system would mean absolute defeat, because of the rapid increase (by doubling) of the sum staked by the gambler. Say, for instance, a bank allows no stake to exceed 1,000*l.*, so that ten doublings of a stake of 1*l.*, raising the stake to 1,024*l.*, would compel the gambler to stop, and leave him with all his accumulated losses, amounting to 1,023*l.* Now, take the case of a gambler trying the other system for a gain of 10*l.*, divided into three sums, 3*l.*, 3*l.*, and 4*l.* under column M, and suppose that after winning a number of times he unfortunately starts ten defeats in succession, his first loss having been 3*l.*; then his second loss was 6*l.*; the third, 9*l.*; the fourth, 12*l.*, and so on; the tenth being 30*l.* His total loss up to this point amounts only to 165*l.*, and is, therefore, much less serious than his loss would have been had he begun by staking 1*l.*, and doubled that sum nine times, losing ten times in all. Moreover, his next stake, according to the system, is only 33*l.*, which is well within the supposed limit of the bank. But on the other hand, to carry on the system, he now has to go on until he has cleared off all the thirteen sums in the column under M. To do this he has to run the risk of several further runs of ill-luck against him, and it is by no means necessary that these should be long runs of luck for the score against him to become very heavy indeed. Be it noticed that at every win he scores off only a small portion of the balance against him, while every run of luck against him adds to that score heavily. And notice, moreover, that while on this system he does not quickly approach the limit which the bank may assign to stakes, he much more quickly encroaches on his own capital—a circumstance which is quite as seriously opposed to his chance of eventual success as the finality of the bank limit. So far as the carrying out of his system is concerned, it matters little whether he is obliged to stop the play on the system because his pockets are emptied, or because the bank will not allow him further to increase his stake.

Similar remarks apply to the following method, which has recently been suggested by another correspondent of KNOWLEDGE as an improved system:—

"My improvements," he writes, "consisted, 1st, in arranging that two players should play in concert, one staking persistently upon one colour while the other staked upon the other. A run of ill luck to one would then be somewhat counterbalanced by the run of good luck to the other, while sometimes both would seem to be winners.

"2nd, in staking the *sum* of the extreme figures in the guide-column only when the number of figures in it was even; when they were odd, *e.g.* 1, 2, 3, 4, 5 only the highest, 5, is staked. Thus the rise of the stakes is considerably reduced, while the principle of the play is still carried out.

"3rd, in splitting up a game when a run of ill luck has occurred into two or more games, and winning these *seriatim*. Suppose, for instance, that the chances of the game have brought the guide-column into the form given in the margin. The player has actually lost 30, and must win 36 to gain 6. He might stake 36, but this would be rash. He should play more cautiously, and convert the column into 3 new columns, totalling 12 each, or even into 4, totalling 9.

−1
−2
−3
3
−4
4
6
6
−9
12

FIG. 3.

The numerals with a *minus* sign are supposed to be struck out.

3 of	1, 2, 2, 3, 4	or 4 of	1, 2, 3, 3
Total	12	Total	9

and play out three or four encounters with the guidance of these columns. If luck makes the securing of success in these a long affair, his partner is meanwhile reaping the benefit of a run upon his colour.

"I believe that, allowing the bank its small advantage, the chance of winning 5 events out of 12, 6 out of 15, &c., is large. But, of course, the possible gain is small compared with the possible loss; and here, I have no doubt, the plan breaks down."

The plan is only safer than the others in the sense that it prolongs the agony. The introduction of two partners does not affect the validity of the system one way or the other: for the chances of each must be considered separately, though their gains or losses are afterwards to be divided. The only point to be considered in that respect is the idea that the bad effects for one partner of a run on a colour would be corrected by the good effects for the other. As a matter of fact, there would be no such compensation. A run on one colour which would set one of the partners two or three hundred pounds to the bad, would perhaps gain for the other forty or fifty pounds at the outside. Then it must be remembered that we not only have to consider the actual loss when an unfavourable colour appears, but its effect on the operation of the system. During an unfavourable run the stakes are rising and the distance to be covered before (if ever) safety is reached is increasing. By the suggested improvements the rate of increase in the stakes is undoubtedly diminished, but the rate at which the desired goal is approached is diminished in equivalent degree. I scarcely recommend any one to test any of these systems experimentally, even though without any idea of putting them into actual practice. It is easy enough to apply such a test by tossing a coin or cutting a pack a sufficient number of times. For, as the essential principle of all such systems is that they depend on the improbability of an event whose occurrence—when it does happen—will involve a heavy loss—a loss more than cancelling all preceding gains—it is naturally likely that any moderately long series of trials will seem to favour the theory, the fatal run not chancing to show in a series of trials too short to give it a fair chance of showing.

It has been thus indeed that many foolish folk have been tempted to trust in a system which has brought them to their ruin. Consider what an irony underlies the gambler's faith in such systems. When he starts with the hope of winning, say, 10*l.*, he is perhaps to some degree doubtful; but he goes on until perhaps he is at such a stage that if he stopped he would be the loser of fifty or sixty pounds. Yet such is his confidence in his system that, although at this stage he is in a very much worse position than at the beginning, the mere circumstance that he is working out a system encourages him to persevere. And so he continues until the time comes—as with due patience and perseverance it inevitably must—when either the bank limit is reached or his pockets are emptied. In one case he has to begin again with a deficit against him much larger than any gain he has probably made before; in the second he has the pleasant satisfaction of noting, perhaps, that if he had been able to go on a little longer, fortune would (from his point of view) have changed. Though as a matter of fact, whether he had had a few hundreds of pounds more or not only affects his fortunes in putting off a little longer the inevitable day when the system fails and he is ruined.

We may compare the trust in a system to such trust as a bettor on races might put in laying long odds—when the odds are really long, but not quite so long as those he offers. Supposing a bettor to lay odds of 30 to 1 in sovereigns systematically, when the true odds are 25 to 1, he will probably win his sovereign on the average twenty-five times in twenty-six trials, but the 30*l.* he will have to pay in the twenty-sixth case (on the average) will leave him 5*l.* to the bad on that set of trials, excellent though his chance of success may appear at each separate trial.

In fine, the moths who seek to gain wealth rapidly and safely by gambling methods and systems are attracted almost equally by two equally delusive flames. They either trust in their own good luck, as in buying lottery tickets, backing the favourite, or the like, hoping to win large sums for small sums risked (these small sums, however, being always in excess of the just value of the chance); or they trust in the bad luck of others, as when they try delusive martingales (though they never see what they are really doing in such cases), or when they lay long odds (always longer than the just odds), hoping to win many small sums at small risk of losing large ones; or they combine both methods. Inevitably, in the long run, they lose more in many small sums than they get back in a few large ones; and they lose more in a few large sums than they get back in many small ones. They lose all round, yet they delude themselves all round into the belief that they are wise.

INDIAN MYTHS ABOUT THUNDER.

By "Stella Occidens."

THE almost universal belief prevails among the North American Indians that thunder is a great bird. The Dacotahs explain in this way the velocity with which thunderstorms travel. A large bird starts the rumbling, and a number of smaller birds keep it up; hence the long duration of the peals. The Indians say that the young birds, or thunders, do the mischief, and are like the young men, who will not listen to the words of wisdom. The old thunder, or bird, does not kill anybody, nor do any kind of mischief.*

The Dacotahs show a place near the source of the St. Peter's, called Thunder-tracks, where the footprints of the thunder-bird are seen in the rocks twenty-five miles apart.† The great thunder-bird is actually supposed to have been shot in Dacotah, and the exact spot is shown.

Mrs. Eastman says that there is no end to the fancies entertained by the Sioux concerning thunder. They believe a thunder-storm to be a struggle between Unk-ta-he, the god of waters, and Wauhkeon, the thunder-bird, for the command of their nation. The following story was related by one of the oldest men in this tribe, who was revered as a medicine man of great powers:—"Unk-ta-he is as powerful as the thunder-bird Waukheon. Each wants to be the greatest god of the Dacotahs, and they have had many battles. My father was a great medicine man; he was killed many years ago, and his spirit wandered about the earth. The thunder-bird wanted him, and Unk-ta-he wanted him, for they said he would make a wonderful medicine man. Some of the sons of Unk-ta-he fought against the sons of the thunder-bird. The young thunder-birds were killed, and then Unk-ta-he took the spirit of my father to teach him many mysterious things."‡

The Dacotah tribes likewise believed in a giant, named Haokah. This being possesses superhuman powers. He dresses in many colours, and wears horns, or a forked hat, to represent the lightning. With his hands he takes the thunder and hurls it to the ground. His face is red on one side and blue on the other, and his eyes are of different colours. He always carries a bow and arrow in his hand, but never uses them, "as one look will kill any animal he wants." His manifestations were fourfold, and one of the four winds was the drumstick he used to produce the thunder.§

The Chipeways represent thunder brandishing a rattlesnake, the symbol of the electric flash, and sometimes they call him the north-west wind, which usually brings the thunderstorm in the region they inhabit.‖ Thunder brandishing a rattlesnake recalls a Passamaquoddy myth, which relates how Glooskap changed "certain saucy Indians into Rattlesnakes because they yelled at the thunder. Long time ago the Rattlesnakes were Indians. They were very saucy. They had too much face. They could not be put down by much, and they got up for very little. When the great Flood was coming Glooskap told them about it. They said they did not care. He told them the water would come over their heads. They said that would be very wet. He told them to be good, and pray. Then those Indians hurrahed. He said, 'A great Flood is coming.' Then they gave three cheers for the great Flood. He said,

* Tylor, "Primitive Culture," vol. i., p. 363.

† Eastman, "Legends of the Sioux," p. 71.

‡ Eastman, "Legends of the Sioux," p. 161.

§ Brinton, "Myths of the New World," p. 164. Eastman, "Legends of the Sioux," p. 158.

‖ Brinton, "Myths of the New World," p. 182.

'The Flood will come and drown you all.' Then these Indians hurrahed again, and got their rattles and rattled them, and had a grand dance. The rain began to fall, and they danced. The thunder roared, and they shook their rattles and yelled at it. Then Glooskap was angry. He did not drown them in the Flood, however, but he changed them into Rattlesnakes. Nowadays, when they see a man coming, they lift up their heads and move them about. That's the way snakes dance. And they shake their rattles in their tails, just as Indians shake their rattles when they dance." *

Among the Canadian Indians the dark storm-cloud is supposed to be a great bird, and the lightnings are regarded as writhing worms or serpents in its beak. These fiery serpents are believed in to this day, and the thunder is their hissing.† These serpents are also referred to among the Algonkin traditions. Michabo had a great conflict with the shining prince of serpents, who lives in the lake, and floods the earth with its waters. He destroyed him with a dart, and, clothing himself with the skin of his foe, he drove the rest of the serpents to the south, "where in that latitude the lightnings are last seen in the autumn." The Iroquois also tell of a great horned serpent "which rose out of the lake and devoured the people," until a hero destroyed it with a thunderbolt.‡

Michabo not only overcame the prince of serpents, but likewise became master of the thunder and lightning, and with these he destroys his enemies. This again bears a strong resemblance to an Iroquois myth, about their thunder god, Heno. He rides through the heavens on the clouds, and hurls thunderbolts at his enemies, often splitting great forest trees, and making vast chasms in the earth with his mighty weapons. He gathers the clouds, pours out the warm rains, and is chosen as patron of industry, invoked at seed-time and harvest, and called grandfather by his children the Indians.§

Some tribes believe that thunder is the voice of the Great Spirit of the four winds speaking from the clouds, telling them that the time of corn-planting is near.‖

The Mississippi Indians believe that the first man ascended into heaven, and thunders there.¶ The following Passamaquoddy myth relates the story of a man who became a "thunder" for a while, but returned to earth after an absence of seven years. The Passamaquoddies believe that the rumble of the thunderstorm and the flashes of lightning are the demonstrations of thunder-spirits, who are playing ball and shooting their arrows in the heavens.** One day a Passamaquoddy Indian wished to become "a thunder." All at once his companions saw him mounting to the sky in the smoke of the camp fire. He was taken up to the abode of the thunders, placed in a long box, and by some mysterious process invested with the properties and existence of a thunder spirit; or, as Louis Mitchell puts it, he was "thunderfied." He lived for seven years among the thunders, played ball with them in the sky, shot his gleaming arrows with them at the bird they are always chasing toward the South, married a female thunder-spirit, and pursued an active and contented life of thunder and lightning. Seven years after his translation a violent storm passed over the encampment of the Passamaquoddies; there was an unusual and frightful contention among the thunder spirits: the rumbles were more terrible than Passamaquoddy had ever heard before; the air smelled of brimstone; the sky blazed with red and yellow flames; the clouds opened, and great forks of fire shot out of them; the rain fell in sheets; peal answered peal; one tongue of lightning spat out fire to another. The Passamaquoddies, who never had beheld such a storm, believed that the legions of the thunder-spirits were waging their most awful war. They fell down and crossed themselves. In the midst of their alarm they saw a human form slide down into their camp on a beam of light. It was their old friend, who had made his escape from pursuing thunders, shaken off his "thunderfied" existence, and returned to them. He had changed somewhat, but all his old friends knew him. On this point, at least, he was more fortunate than poor Rip Van Winkle, whose story, in some respects, resembles the above. The legend quaintly concludes with the words, "He lived with his tribe till he died."*

This myth agrees almost word for word with a legend found in the manuscript of Louis Mitchell. These "thunders," however, had wings. The chief would give them orders when to put them on, and always warned them not to go too low, for "it is sure death for them to be caught in the crotch of a tree." The roar and crash of the thunder is the sound of their wings, and their great amusement is to play ball across the sky. When they return they carefully put away their wings for their next flight. Leland considers that this legend is unquestionably of Eskimo origin, or common to the Eskimo; also, because it speaks of thunders as always endeavouring to kill a great bird in the south. This is probably the thunder, or storm-bird, called by the Passamaquoddies *Wochowsen*, that is, Wind-Blower. Another legend makes Thunder and Lightning the sons of Mount Katahdin.†

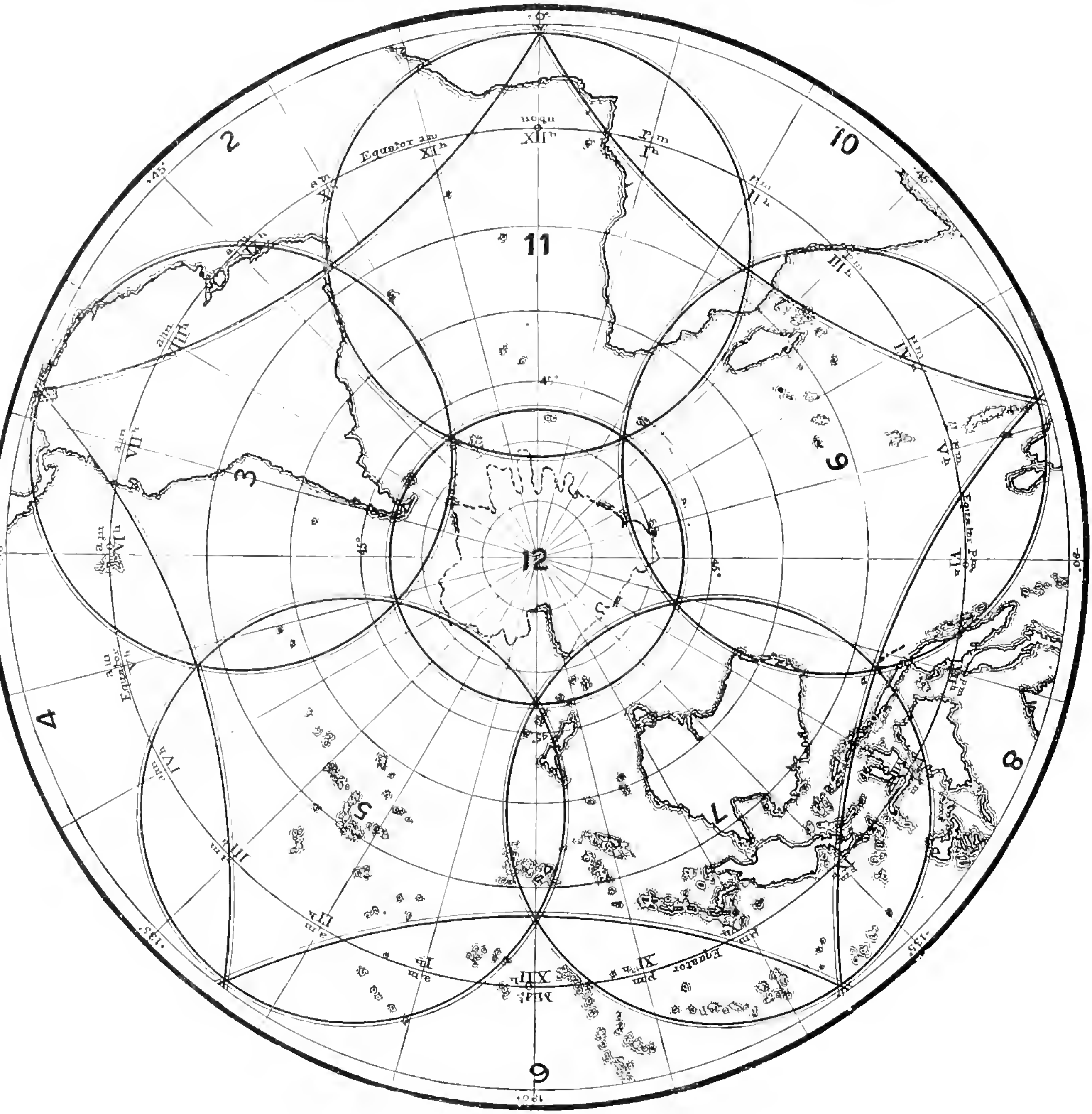
With regard to the Wind-Blower, the following tale is told by the Passamaquoddies:—"The Indians believe that this bird lives far in the north, and sits upon a great rock at the end of the sky; ‡ and it is because whenever he moves his wings the wind blows, they of old times called him that. When Glooskap was among men, he often went out in his canoe with bow and arrows to kill sea-fowl. At one time it was every day very windy; it grew worse; at last it blew a tempest, and he could not go out at all. Then he said, 'Wuchowsen, the Great Bird, has done this!' He went to find him; it was long ere he reached his abode. He found, sitting on a high rock, a large white bird. 'Grandfather,' said Glooskap, 'you take no compassion on your *Koosesek*, your grandchildren. You have caused this wind and storm; it is too much. Be easier with your wings!'

'The Giant Bird replied: 'I have been here since ancient times; in the earliest days, ere aught else spoke. I first moved my wings; mine was the first voice, and I will ever move my wings as I will.' Then Glooskap rose in his might; he rose to the clouds; he took the Great Giant Bird Wuchowsen as though he were a duck, and tied both his wings, and threw him down into a chasm between deep rocks, and left him lying there. The Indians could now go

* Leland, "Algonkin Legends," p. iii.
† Fiske, "Myths and Myth-makers," p. 51.
‡ Brinton, "Myths of the New World," p. 122.
§ Tylor, "Prim. Cult.," Vol. II., p. 305.
‖ Schoolcraft, "Indian Tribes," i., p. 319.
¶ Tylor, "Prim. Cult.," Vol. II., p. 312.
** In North Germany, the peasants still say of thunder that the angels are playing skittles aloft; and of the snow, that they are shaking the feather beds in heaven. Baring-Gould's "Book of Werewolves," p. 172. [In Brittany, the same idea of skittles or bowling games going on in heaven prevails: "The gods are playing at bowls" the servants tell the children when it thunders.—R. P.]

* Extract from *The Lewiston Journal*, and reprinted in *New York Tribune* for September 30, 1886.
† "Algonquin Legends of New England." Leland, p. 265.
‡ Compare this with the account of Hroesvelgr, the name of a giant referred to in the Edda. "In the shape of an eagle he sits at the end of heaven; from his wings cometh all wind upon men. He sits at the north side of heaven, and when he flaps his wings, the winds flap from under them." The Hindus also believe that tempests come from Garuda's wings. "Somadeva," 22, 102; the motion of his flight stirs the wind. Grimm's "Teutonic Mythology," Vol. II., p. 633.

out in their canoes all day long, for there was a dead calm for many weeks and months. And with that all the waters became stagnant. They were so thick that Glooskap could not paddle his own canoe. Then he thought of the Great Bird, and went to see him. As he had left him he found him, for this bird is immortal. So, raising him, he put him



SOUTHERN INDEX MAP, SHOWING THE SOUTHERN HEMISPHERE, AND PART OF THE NORTHERN ON THE STEREOGRAPHIC PROJECTION.

on his rock again, and untied one of his wings. Since then the winds have never been as terrible as in the old time."

This story is also from the original, and found in the manuscript of Louis Mitchell (an Indian member of the Legislature of Maine, whose researches are of great interest). The main incidents of this story are repeated in Tumilkoontaoo, the Broken Wing, from the Micmoc, but there is no mention of Glooskap.*

Glooskap, as the greatest magician, subdues the Giant of the North, the terrible god of the storm. The winds must have been terrible in those olden times if the winds of the present day have only half the strength of former storms.

* "Algonquin Legends." Leland, p. iii.

A ONE-SCALE ATLAS.

THIS month we give the southern index map, which, with the northern map on the same plan, given last month, presents the whole sphere, and as divided for the purpose of the one-scale atlas, the maps of which are now in hand.

THE SOUTHERN SKIES.

DECEMBER, JANUARY, AND FEBRUARY

THERE are few features of a journey south more interesting than the change by which night after night new stars are brought into view. Low down towards the southern horizon constellations unknown in our northern heavens are seen hour by hour, night after night. As the stout ship ploughs her way onwards the star groups already seen creep gradually higher in the southern skies, fresh groups taking their place along the southward verge of the star canopy. The stars which had been overhead at home pass downwards towards the north; the stars which had been high in the southern skies pass overhead, and are seen northwards; and the stars which had been high towards the north sink lower, or pass beneath the northern horizon. But changes such as these attract less notice than the changes towards the south, because they bring no new stars into view, whereas not a clear night comes in any voyage towards the south but stars never seen in our latitudes can be recognised low down in that direction. It is as when we climb a rounded hill, seeing at each step new features beyond its outline, only that though we are rounding a globe surface in travelling we cannot be said to *climb*, seeing that our distance from the centre remains unchanged save for the oblateness of the earth's spheroidal globe.

It has seemed to me well (the idea occurred long after this work was well entered on) to use these southern maps to illustrate the change of the heavens towards the south in southward travelling, as well as to show (which was their primary purpose) the aspect of the southern heavens, month by month and hour by hour, in southern latitudes. Thus these maps may serve as companions for travellers from northern to southern regions, enabling them, at whatever time their journey may take place, to recognise the new stars rising steadily above the southern horizon as they themselves advance steadily southwards.

Suppose, for instance, that the traveller is on his way south from the latitude of the middle of the British Isles, in the month of February. The map of the southern skies in the present number of KNOWLEDGE presents in its upper half the southern half of the heavens as seen at the hours named underneath the map, in England and Wales, Scotland and Ireland, or in any part of the northern hemisphere in the same latitudes. Of course this is only absolutely true for one exact latitude, viz., 52° north, but it is quite near enough for ordinary study of the star-strewn heavens between latitudes 45° and 60° north. The point marked Z, which, as the map is intended to be used in the southern hemisphere, represents the north point of the horizon, is the zenith, or point overhead, for the northern use of the map I am now considering. The point E is on the horizon due east, the point W is on the horizon due west—in both uses of the map; but whereas for the southern use E O W represents a semicircle passing from east at E overhead at O to west at W, in the northern use it represents the horizon from east at E to due south at O and to west at W.

In England, then, we have at the time and hours named under the map, *Orion* at his highest nearly due south. Almost overhead is the night star *Capella*, α of the Constellation *Auriga*. Along the horizon we have *Hydra* in the south-east, a great vacant region all around, a part of the poop of *Argo*, *Canis* the Greater Dog, *Columba* the Dove, *Eridanus*, the Great River, and the upper half of the body of *Cetus* the Sea Monster.*

Travelling southwards, it is the stars below O in our map which at the times named below the map are coming gradually into view. More and more of *Argo* rises above the horizon somewhat to the east of the south point, more and more of *Eridanus* towards the south-west. The south point of the horizon advances along the south pole of the heavens as the traveller advances towards the south, and at a rate varying precisely as his does, for the plan of the projection is such that equal distances on the star sphere are represented by equal distances along all diameters of the map. The varying southern horizon is not shown in the maps, but can easily be pictured as an arc (not far from circular) running from E to W through the south point of the horizon, advancing southwards as described.

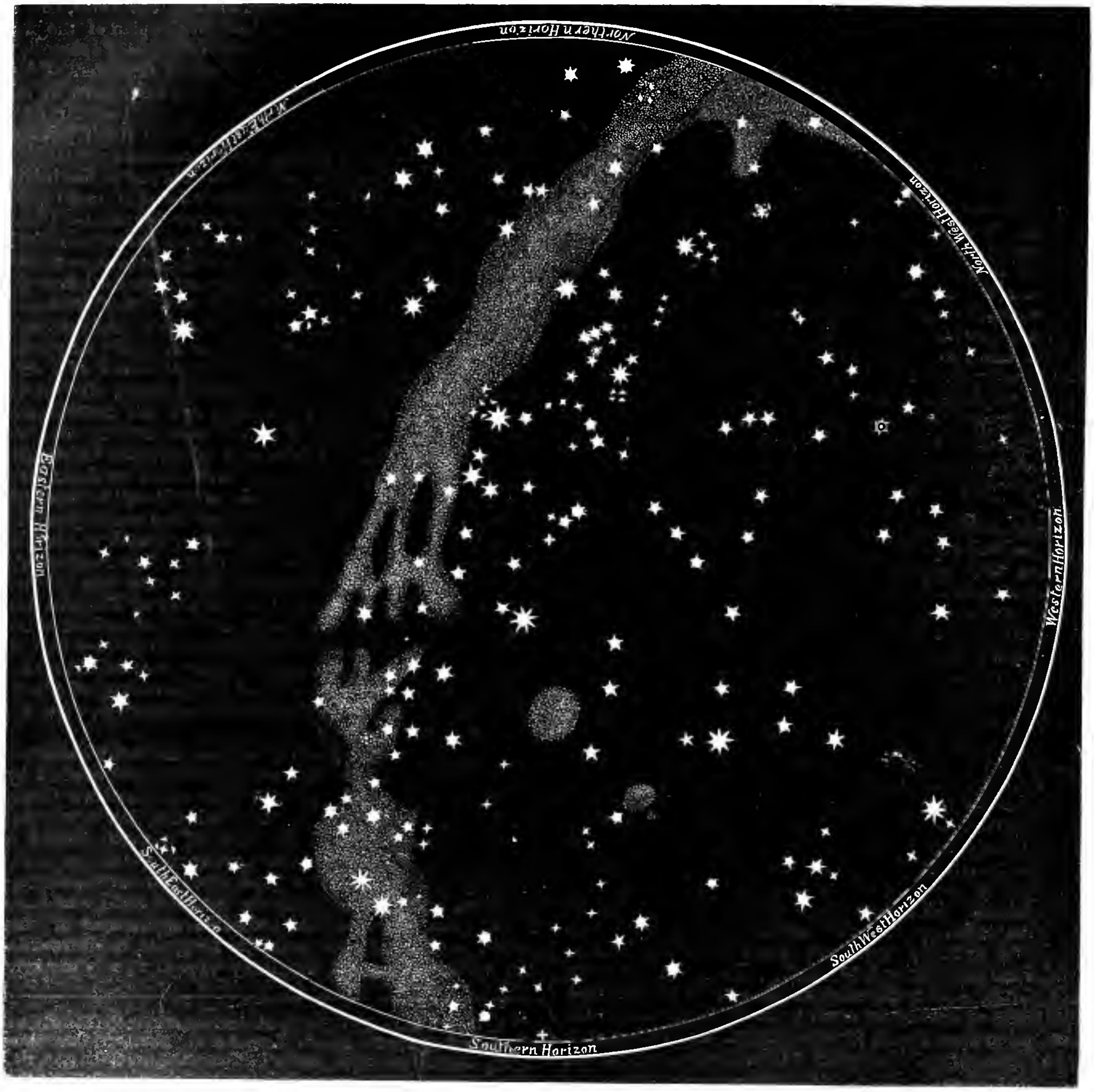
After travelling southward to about 38° north, the bright star *Canopus* comes into view somewhat east of south. At about 25° north latitude the Greater Magellanic Cloud begins to be seen due south. Soon after the whole of this strange congeries of stars and star clouds has become visible, the southern horizon, shifting southwards, passes below the whole of *Argo* on the eastern side, and the whole of *Eridanus*, even to the bright *Achernar*, on the western. As thus seen *Argo* certainly suggests no resemblance to a ship, unless the imagination rises to the thought of the stern half of a ship plunging almost vertically downwards beneath the waves. But with that idea, and including half the constellation *Canis* and the whole of *Columba*, remembering also the form of the old-fashioned ships such as Egyptian, Greek, and Roman carvings show them, we have about as fine a star-drawn picture of a foundering ship as could well be expected. It adds to the interest with which we thus contemplate the conception of very ancient imaginations, indeed, to consider that the great star-ship thus seen in our days so strangely situated was like a ship drawn stern foremost into harbour (that is, only slightly slanted) in the days of Eudoxus and Aratus. The Great Ship was on an even keel, and the whole of it—from its poop, where we now see the Greater Dog, to its bows, where we now see the *Centaur*—was well above the horizon of the Great Pyramid and Babylon—nay, of Athens and of Rome—fifty-two or fifty-three centuries ago, when the Great Pyramid was built.

At the equator the south pole rises above the horizon—we cannot say it comes into view, for it is not marked by any conspicuous star. At this time the Southern Cross, *Crux*, is rising into view in the south-east, but not in that position which suggests the idea of a cross: indeed a traveller who had reached the equator at the season corresponding to Map II., and only observed the heavens during the hours before midnight as he travelled south, could not at all have recognised the cross-like appearance of this small constellation; nor could he recognise it afterwards. The Southern Cross, paradoxically enough, is only properly

* It should be noticed that equal distances along the horizon are represented by equal distances along E O W. Moreover, those star-groups to which we direct chief attention in this use of the map, viz., those low down towards the south (near O therefore) are very little distorted. It is near the circumference of all these maps that the chief distortion, resulting from showing a hemisphere in a circular map, comes in. We have a fair picture of the horizon constellations *Canis*, *Orion*, *Lepus*, *Columba*, and *Eridanus*, in the second map of our series. In this sense the maps of the present series will form a useful supplement to the maps of my Star Primer, as those in like manner will form to these; seeing that the constellations near the horizon are distorted in one set (as if stretched out parallel to the horizon) and undistorted in the other, and *vice versâ*. Note further that the maps published each month serve as well (though for different hours) for England, where they appear at once as for southern places, which they only reach two months or so later.

seen as a cross in the northern hemisphere. This we shall see more clearly in studying later maps.

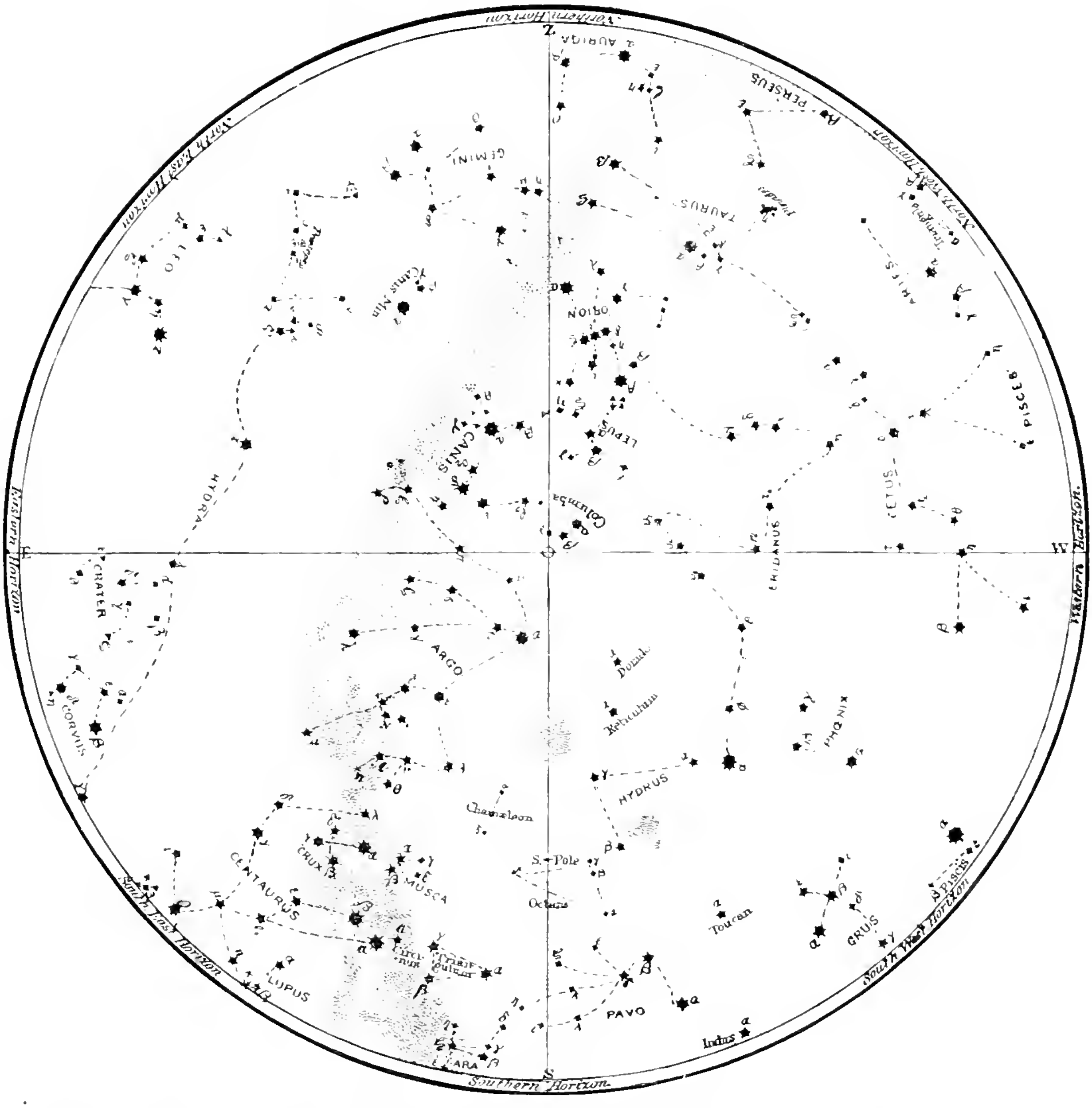
Passing farther south still, our traveller finds the south pole rising, the north having now passed out of view. The pole star—I mean our northern pole star—cannot be seen further south than latitude 1° 50′, and then only through the refractive action of the air, and when the pole star is is no conspicuous star close by the pole. If the night is very clear and dark, however, the traveller will be able to detect, close by the south point of the horizon, determined as I have just indicated, three small stars in a row. These are very close to the true pole, and will be seen to occupy the same region all through the night, only altering in position, like the hand of a small dial set just above the



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT 46° TO 24° S.) AND THE SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY). For Index Map see opposite page.

at its greatest distance above the pole as seen in northern latitudes. In February, for a short time after sunset, the traveller when a degree or so south of the equator can see the pole star above a sea horizon, marking almost exactly the north point of the horizon. The point of the horizon almost exactly opposite is at this time about a degree and a half below the true south pole of the heavens. But there southern horizon. It is as well to identify these small stars at this favourable time, when the observer, being a degree or so south of the equator, sees them close to the horizon. Later the observer may only be able to detect them with some difficulty.

Travelling farther south the south pole rises higher and higher, until, when in latitude 38° south, the stellar skies present the exact scene indicated in Map II., at the times mentioned underneath it. In any latitude between 30° and 46° south the map will serve very well for the identification of the principal star groups. As an illustration of this range in the latitudes over which such maps can be used, I may instead of this wide range of 28° I would suggest only a range of about 16°—viz., from 30° to 46° (north or south respectively). And, of course, the nearer the latitude of a place is to 38° the more correct the present series of maps will be found.



The Night Skies in the Southern Hemisphere (Lat. 46° to 24° S) and the Southern Skies in England (Upper Half of Map only):—

1 o'clock morn, Dec. 7	11 o'clock, Jan. 7	9 o'clock, Feb. 6
12.30 o'clock, Dec. 15	10.30 „ Jan. 14	8.30 „ Feb. 14
Midnight, Dec. 23	10 „ Jan. 22	8 „ Feb. 21
11.30 night, Dec. 30	9.30 „ Jan. 29	7.30 „ May 1

mention that the maps of my "Star Primer," constructed specially for the altitude of the middle of England, have been used in America as far south as latitude 38°. Maps constructed for latitude 38° north or south, might with equal propriety be used for latitude 52° (north or south respectively), or for latitude 24° (north or south); but

USE OF MAP II. IN SOUTHERN LATITUDES.

When using the map in the latitudes for which it is specially intended the student is to remember that the rim of the map represents the horizon, while the centre marks the point overhead. Thus, to determine what constellations lie towards any point of the horizon, the student is to bring the corresponding part of the map's circumference below the centre O, and to consider only those groups which he finds lying between O and that part of the circumference.

Thus, towards the south he sees *Pavo* the Peacock; low down, and upside down, half of the Altar, *Ara*, being visible slightly to the east of south, and in a similarly inverted position. Above the altar, and eastwards of it, lies *Triangulum* the Triangle (the northern constellation similarly named shows two triangles, and may be conveniently called the Triangles or *Triangula*, as in both my Library and School Star Atlases.)

In the south-east is a singularly interesting region of the heavens. Low down is *Centaurus*, the Centaur, the bright star Alpha in which is celebrated as the nearest star (so far as is known) in the heavens. It lies at a distance of only about twenty millions of millions of miles from the solar system; a light journey of about three and a half years. *Crux*, the Southern Cross, occupies the place where formerly were the Centaur's hind feet—a change which has injured the latter constellation, without giving the southern skies a constellation in the least resembling a cross, except when so high above the horizon that the suggestion of an upright cross is lost.

In the south-eastern quadrant the Milky Way is full of strange features: the great Coalsack, a sharply-defined semicircular outline near λ *Centauri*, and the great fan-shaped expansions in Argo, between which is a broad dark space. But still more remarkable than the Milky Way here, or than the *Magellanic Clouds* seen high in the south, is the immense starless tract running between *Hydra* and the Milky Way. Indeed, although the groups forming *Corvus* the Crow, and *Crater* the Cup, here come close up to Hydra, of which doubtless they originally formed a part, the starless region farther northwards is only broken (so far as conspicuous stars are concerned) by the solitary star Alphard (*α Hydræ*), over the whole space between *Argo*, *Canis*, and *Orion* along one side, and *Leo*, *Cancer*, and *Canis Minor* on the other. Even Cancer contains so few bright stars that it used to be known as the dark sign, and beyond Cancer northwards the starless space expands over *Lynx* and *Camelopardus* (unseen in the southern skies).

In the north-western quadrant we find *Taurus*, *Aries*, *Cetus*, and *Eridanus*, in the places shown in the map; and in the north-western quadrant the rest of *Eridanus*, *Hydrus* (the Water Serpent), *Phœnix*, *Grus*, and a part of *Piscis*, the Southern Fish, with the bright star *Fomalhaut* (and *Piscis*).

NOTES ON AMERICANISMS.

By Richard A. Proctor.

Far's-I-know, which Bartlett for unknown reasons writes "Farzino," is an abbreviation of "as far as I know," often heard in New England and New York. Common enough in England.

Favoured. Bartlett wildly remarks that the use of this word as applied to the face, once common in England, is now obsolete, giving as examples of the old English, use of the expression Shakespeare's "A good *favour* you have, but that you have a hanging look," and from the *Spectator* the sentence, "The porter owned that the gentleman *favoured* his master," meaning that he resembled him. These are examples of two entirely distinct ways of using the word; but neither one nor the other is obsolete. The former, as when we say the man is *ill-favoured*, or *well-favoured*, is not only not obsolete but is in use by persons of culture and admitted into the best dictionaries; it shows, so far as I can judge, no signs of going out of favour. There is, however, an extension of the usage which I believe to be seldom heard out of America, viz., in such expressions as *long-favoured*, *square-favoured*, or the like, meaning that the face is long or square, or so forth. The other use of the word is common in England, but not admissible in literature or in the conversation of educated persons. Thus you will hear almost anywhere in England the remark, "So and so favours his father," meaning that he looks like his father in the face. I remember hearing the expression for the first time, and being very much perplexed by it, when I was a small boy; a nurse who had left my mother's service some time called one day with a baby, which she showed with some pride to her former mistress. Presently she remarked, "I think he favours Master Richard," which astonished me, as I had seen no marks of any special favour towards me—on the contrary, he had howled obtrusively at my approach; but since then I have heard the expression dozens of times among the poorer classes. In Walker's dictionary we find this use of the verb *to favour*, as well as the Shakespearian use of the noun "favour" for the features, presented without any suggestion of obsoleteness or even of obsolescence.

Fearful, used as we use "awful," fearful big, fearful ugly, and so forth, seems appropriately enough to be peculiar to the Quaker State Pennsylvania.

Feaze, same as *feeze*, *pheeze*. Bartlett seems quite in the dark about this good old English word, which he derives from the French *fâcher*, to vex. It was used formerly in the same sense as *tease*, as in teasing wool, but more particularly applied to curry-combing. It has no connection whatever with *fâcher*. "I'll pheese you in faith," says Christophero Sly, meaning that he will vex the worthy hostess by staying like teasel in wool. In America *feaze*, *feeze*, and *pheese* are still used not only in speech but in writing. "When a man's in a feeze there's no more sleep that hitch," says Sam Slick.

Federal Currency. The legal currency of the United States.

Feed, for *grass*, as "tall feed" for "high grass."

Feel, short for *feel inclined*, is used in America, where in England people are more apt to say, "feel like doing." "I don't feel to work to-day" would correspond with our English colloquialism, "I don't feel like working."

Feeze, see "Fease."

Fellow, short for "Black Fellow," is Southern. "Fellow," or "feller" for sweetheart is rather absurdly given by Bartlett as an Americanism. It would be difficult to say whether it is more commonly heard in that sense in America or in the old country.

Fellowship, To. "To fellowship with" is one of the real Americanisms which the *Saturday Review* would like to see alone in such a list as this. It is used chiefly in religious newspapers (the vulgarity of which in America has become a by word), to indicate communion in religious doctrine and discipline. The barbarism assumes two forms: thus a Baptist (let us say) may refuse "to fellowship" with a Methodist, or refuse "to fellowship" him, or *vice versâ*.

Female. Bartlett complacently discusses the use of this word for "woman" as an Americanism. Would that it were the invention of our Transatlantic cousins; but, alas! the vulgarism is but too obtrusively English to be thus got rid of. It is not only English, but the Queen's English, not in the vulgar use of that absurd expression (absurd seeing that the Queen's German is fifty per cent. better than her English), but literally; for did not the Queen write to the Mayor of Birmingham, expressing her "horror that one of her subjects—a female—should have been sacrificed," &c., the sacrificed "subject" not being a cow or a female retriever, as might be imagined, but a woman who had fallen from a rope on which she had tried to walk blindfolded, and in a sack. Our Mrs. Browns are rather fond of applying the term to themselves—though I am not aware that they ever, as "Arthur Sketchley's" Mrs. Brown is made to do, call themselves "fieldmales." If you speak of a housekeeper as a "woman," even addressing her as "my good woman," she will be ready to tear your eyes out; but if you speak of her as a "female" she is rather flattered than otherwise. Why "a male" has not yet come to be regarded as an appropriate way of describing a man is not clear. Possibly we shall learn the reason when we find out why a woman may be called simply "a petticoat," while no one ever yet thought of making "a pair of breeches" do duty for a man.

Fen, To. It is interesting to learn that this word is still used by American boys, as by boys in England. *Fain* we used to pronounce it at school. In London, "fain larks" is synonymous with "stow larks," that is "no tricks, I entreat of you." Probably "fen" is nearer the original sound, the word having probably been "fend" in the sense of "keep off," "avoid."

Fence. To be "on the fence" corresponds in America to being "Jack-o'-both-sides" in English. A man who tries to run with the hare and hunt with the hounds is "on the fence"—"impartially ready," as Lowell puts it—

"... to jump either side,
And make the first use of a turn of the tide."

A man on the fence is apt, however, to give offence to both sides, instead of pleasing both as he fondly hopes to do.

OUR PUZZLES.

In fig. 1, we have the solution of my new and improved puzzle (No. X.) about nineteen trees, according to which they are to be arranged, not in *nine* but in *ten* rows, five to each row.

In fig. 2, we have the solution of my improved form (Puzzle XI.) of the puzzle about cords and pegs, according to which six cords (all equal in length, if it be preferred to add that condition) are to be so fastened to nine pegs as to inclose (1) six triangular spaces all equal and similar, (2) three quadrangular spaces axially symmetrical, and (3) one hexagonal space having equal sides and three axes of symmetry.

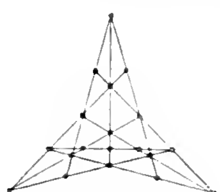


Fig 1.

Showing Nineteen Trees in Ten Rows, Five in Each.

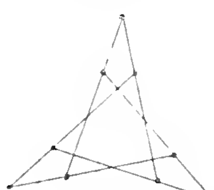


Fig. 2

Showing Six equal Cords, fastened to Nine Pegs, and inclosing Ten Spaces Symmetrically.

Puzzle XII. When I turned to the investigation of this puzzle, I found that it was not the same as Mogul's Puzzle in Vol. I. (rather ridiculously indexed The Mogul's Puzzle), but slightly more difficult because more general.

It may be presented in two forms; thus:—

Given a rectangular carpet, to divide it by the fewest cuts into pieces which shall cover

1. An equal given rectangular area, or
2. An equal rectangular area of given shape.

Of course problem 2 involves the solution of problem 1, which was Puzzle XII. as given; but it is well to note that this, the more general form, may be dealt with directly: by which I mean that instead of first finding out by geometry the sides of the rectangle fulfilling the conditions in 2, and then solving the puzzle for that rectangle, we may employ a construction which, in solving the puzzle, will give us the rectangle both in shape and size.

Two solutions of the second form of the problem are illustrated in figs. 3 and 4, the preliminary construction

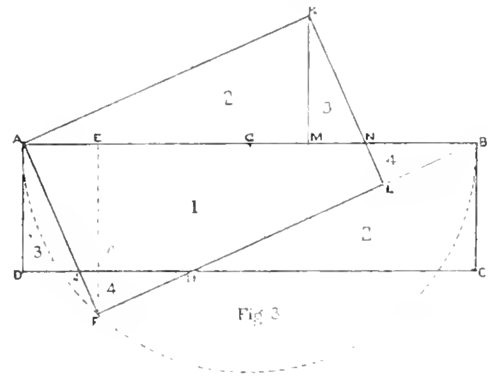


Fig 3

being only given in one case. The given rectangle is ABCD, and the rectangle AEGD, cut off from the length of AC, represents the shape of the rectangle to be covered by sections of AD, AE corresponding to the shorter side. On AB the semicircle AFB is drawn. EG produced to meet it in F, and AF and FB, cutting DC in J and H, are drawn: then AF is one

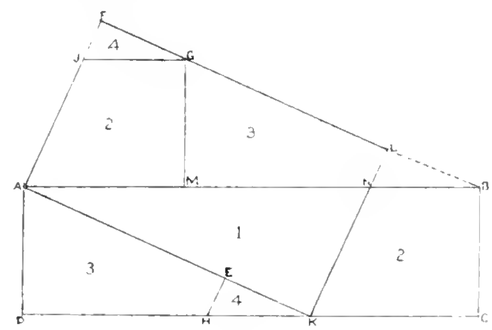


Fig 4

side of the required rectangle, and BH is the length of the other. Completing the rectangle FK, we get the remaining cutting line, NL, in the case illustrated by fig. 3. In the other case, FB lies wholly above AB; but AK, parallel to FB,

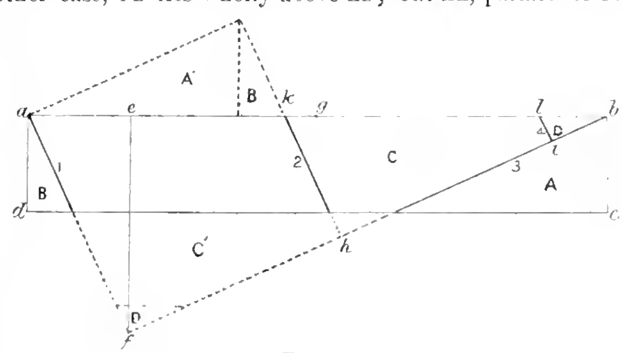


Fig. 5.

cuts DC in K, giving AK, the other side of the required rectangle, which we complete by drawing KL. Then to complete the cutting lines we have to take EK equal to LB, HK equal to NB, and join HE.

The numerals in both figures show how the pieces of rectangle AC fit upon rectangle AL.

There result many varieties of cutting, according to the shape of the given and required rectangles. Figures 5, 6.

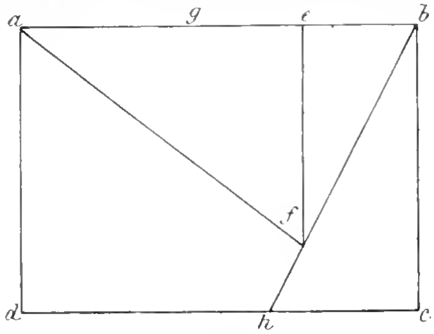


FIG. 6.

and 7 (Mogul's), show some of the varieties for the first method (*hi*, in fig. 5, is equal to *fh*. Where either rectangle is very long, more equidistant thwart cuts parallel to AF,

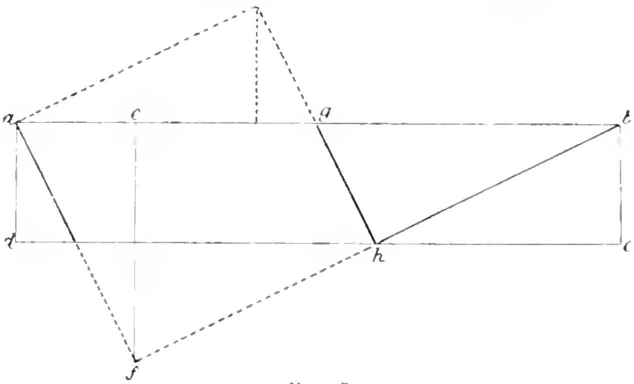


FIG. 7.

or *af*, will have to be made). Similar diversities will readily be dealt with in the case of the second method.

PUZZLES FOR THIS MONTH.

PUZZLE XIII. *Show how a parallelogram, as* ABCD, *fig.* 8, *may be divided by the fewest number of lines so that the*

Fig 8

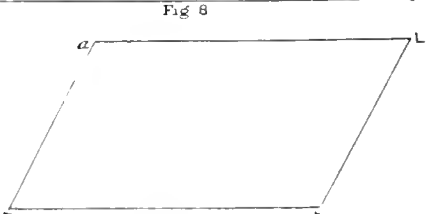


Fig 9

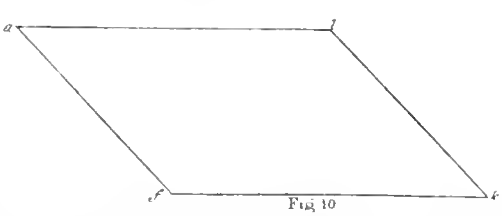


Fig 10

pieces may fit another parallelogram, aFKL, *fig.* 9, *having angle at* a, *equal to angle at* A, *by a method akin to the first described above.*

PUZZLE XIV. *Show the same by a method akin to the second.*

PUZZLE XV. *Divide* ABCD, *fig.* 8, *into three pieces so as to cover the parallelogram afkl, fig.* 10.

THE WHIST-PLAYERS' PUZZLES.

(See KNOWLEDGE for October and November.)

IT *is required to arrange sixteen persons to play whist on five days, each day retaining their places unchanged throughout, so that no two shall twice sit at the same table.* I take first the subordinate puzzle:—*To arrange twelve persons to play whist on five days—single dummy on four days, full whist only on the remaining day—no two sitting twice at the same table.* The direct method of solution is similar to that employed for the fifteen school-girls. It would take little time to run through the combinations, because we might at once set out three combinations of four each, the single day of full whist, and these limit us effectively in making out the sixteen combinations of three each out of which the four days of single dummy are to be provided for.

But the simplest way of proceeding is as follows:—

Write after A four pairs of letters, and one triplet, in alphabetical sequence, giving the first table of the following set:—

Table I.	Table II.	Table III.	Table IV.	Table V.
A B C				
A D E				
A F G		B E J	C D J	D G L
A H I	B D F H	B G K	C F K	E H K
A J K L	C E G I	B I L	C H L	F I J

To make the other sets of four take the two columns headed B and C in the first table, getting the second table. Get three sets beginning with B by taking E, G, and I from the right-hand vertical column of Table I. with J, K, and L of the lowest row; and get three sets beginning with C in like manner. These form Tables III. and IV. Lastly, get three more combinations by taking D, E, and F, each with the only pair of the letters G, H, I, J, K, L, remaining available—getting Table V.

From these sets we obtain quite easily the following solution:—

1st day.	2nd day.	3rd day.	4th day.	5th day.
A B C	A D E	A F G	A H I	
D I K	B G K	B I L	B E J	A J K L
E F L	C H L	C D J	C F K	B D F H
G H J	F I J	E H K	D G L	C E G I

Take now the problem of the sixteen. We have first to get twenty combinations of four, no two in any of which will be twice in the same set. To do this we begin with Table I. below, written out in the usual way:—

Table I.	Table II.	Table III.	Table IV.	Table V.
A BCD				
A E F G	B E H K	C E L N	D E O I	
A H I J	B F N J	C F I M	D F K P	E P J M
A K L M	B G O M	C G H P	D G L J	F H L O
A N O P	B L I P	C K O J	D H N M	G K N I

We deal with the twelve letters E F G . . . to P (lined off in Table I.), so as to form from them four arrangements, just as the four arrangements belonging to the 2nd, 3rd, 4th, and 5th days above are formed from the arrangement belonging to the 1st day. (We may either do this independently, or, in the arrangements just obtained for five days, we may write throughout E for A, F for B, G for C, H for D, I remains I, J for K, and so on; that is, for each letter in the 1st day's arrangement, write the letter in the corresponding part of the portion of Table I. lined off.) We thus get four arrangements to be taken with B (those corresponding to the 2nd day's arrangement in the former problem, giving Table II.; four to be taken with C (those corresponding to the 3rd day's arrangement), giving Table III.; and four to be taken with D (those corresponding to the 4th day's arrangement), giving Table IV.; while there remain three sets of four which form Table V., and complete the required 20 combinations of four letters in which no two letters appear twice together.

We now have to work these 20 combinations together to give us the arrangements for our five days' play. We have very little trouble in obtaining the following result:—

1st day.	2nd day.	3rd day.	4th day.	5th day.
A B C D	A E F G	A H I J	A K L M	A N O P
E P J M	B L I P	B G O M	B F N J	B E H K
F H L O	C K O J	C E L N	C G H P	C F I M
G K N I	D H N M	D F K P	D E O I	D G L J

Gossip.

By Richard A. Proctor.

I should have thought that if anything could be clear from my remarks on the *Saturday Review* critique of my "Notes on Americanisms," it would be that I remained in doubt as to its authorship. But as I find from letters which have been addressed to me on the subject, that I quite obviously suppose A wrote it, as obviously suppose B wrote it, and not less obviously attribute it to C, it is evident I must be mistaken. At the outset I stated in so many words that my critic *might* be one I had condemned with deserved severity for some offence of his, yet A and B, whom I never have condemned severely or mildly, deservedly or otherwise, believe that I certainly considered each of them (severally) to be the author. I stated with equal distinctness that my critic *might* be one who had received at my hands nothing but kindness, and A and C, to whom I am under personal obligation for kindness received, consider I *must* mean them, severally and individually. I spoke of envy as having possibly moved the author; yet B and C, who have assuredly no reason to envy me, and whose work I admire with a feeling not indeed envious, but implying a clear perception that they severally are able to do well what I wish vainly I were able to do at all,* take my remarks to themselves.

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Then again, I collect *more meo* (or rather in the usual scientific way) all the points of evidence I can recognise, noting them *en passant* as points to be considered when—hereafter—I endeavour to form an opinion as to the authorship of the critique; and A, B, and C, to each of whom some of those points seem to correspond, consider that I must have already formed my opinion and that it must point to them individually and severally! I express a certain degree of confidence as to who has certainly not written the article, or as to circumstances which must probably not be understood precisely as they seem; and it is incontinently assumed, equally by A, by B, and by C, that such negative inferences imply positive conclusions:

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I write these lines at a fortnight's postal distance from London, and therefore it will be understood that I have not seen the November number of Knowledge. I am told, however, that one of the most esteemed of all those contributors who have put me under obligation by writing articles for Knowledge, one in whom I have such full confidence that the printers have standing instructions to put whatever he may write for us in type forthwith, has thought it necessary to explain in Knowledge that he is not the author of the *critique*. I hope this is not so, or that he has changed his mind in the *interim*. Being in doubt on this point, I write necessarily under somewhat inconvenient conditions. But I can do no harm by saying that though some of the points of evidence noted in my remarks may correspond with him, nay with him alone, they are not such points as would determine the authorship, and are flatly contradicted by points far more directly and obviously decisive. A man might communicate from some distant place casual notes on errors I may have made (or which I seem to have made) without any unfriendly feeling, and without any idea that such notes were to be used in a spiteful or unfair manner; yet evidence suggesting that the idea of certain criticisms had come from such a place, would have to be considered in arriving at a conclusion. The same man might have started the first idea of a quaint jest without being at all responsible for its spiteful application by someone else nearer headquarters. The evidence apparently referred to as pointing to him, may—and in this case must—point to someone else, and yet might be of use as indicating some one likely to have come across ideas which had been thus quite innocently advanced.

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There should, however, in this case have been enough to show that, whatever indirect influence I might rightly or, perhaps, quite wrongly have attributed to that friend at a distance, I could not have attributed the critique to his pen. His style is unmistakable; I believe no one living could imitate it effectively; the style of the critique is altogether different as well as altogether inferior. His tone is uniformly and emphatically manly; the tone of the critique is not even mannish, but, as I definitely pointed out, womanish. He certainly could not have fallen into one out of ten of the mistakes which crowd the *Saturday Review* "Notes on Americanisms." Moreover, it is clear that if my remarks were all intended to apply to one person, instead of being conditionally applied to at least four (to this one under such and such conditions, to another under others, and so forth), then I must regard that one person as a false friend, who has repaid kindness with injuries. Now I have spoken above of my friend at a distance, and he will, I trust, permit me to speak of him as a friend in that sense; but the esteem and admiration one may feel for a man whom one has met but four or five times, would certainly not justify the suggestion of long and intimate antecedent friendship implied when such an expression as "false friend" is employed. Only one who has been a close friend for years can show himself a false friend. Adding to this, the consideration that he has never been in the slightest degree under obligation to me—but I, on the contrary, to him—my friend ought not to have considered that I imagined him to be the writer of the critique, though I may have imagined (quite erroneously, I now know) that the reviewer had tipped some of his arrows with metal from my friend's mind, while I fully recognised that the bow and the arrow,

* *Qui invidet minor est*, says the Cadogan motto, justly; but it does not necessarily follow that *Qui minor est invideat.*

and also the venom in which the arrow tips were dipped, belonged wholly and solely to another.

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A correspondent calls my attention to the name "Krishna Jezeus." He says that he has come across the epithet Jezeus as applied to Krishna in several modern treatises, but it is not a correct transliteration of anything possible in Sanscrit or in any of the Dravidian languages of South India. He has failed to find any original authority for the name. Like my correspondent, I am unable to understand the modern use of this epithet, which I have used as I found it, supposing it might be a form of one of "the thousand names of Krishna"—with some of which I am not familiar. I noticed its want of resemblance to the better-known names, most of which end with the vowels "a," "u," and "i," as Dâmodara, Mâdhava, and Madhuripu, Achyuta, Kes'ava, Govinda, Hrishikes'a, Trivikrama, Vâsudeva, Padnanâbhi, &c., &c. Knowing absolutely nothing as to the real source of the epithet, but recognising it as an impossibility in connection with any Indian language, I venture the suggestion that it may have been borrowed from some ancient Latin writing, in which, because of the close resemblance between the story of Krishna (the representative during his life on earth of Vishnu, the second person of the Indian Trinity) and that of Christ, Krishna is called Jezeus; in other words, it may be a barbarous attempt to find some adjective other than Jesuit which would represent association with, or resemblance to, Jesus—so that Krishna Jezeus would signify the Jesus-like Krishna. But I should say the chances must be heavy against this guess being correct.

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A correspondent at Bristol has addressed to me a rather remarkable letter, the bearing of which may perhaps be more obvious to some of my readers here than it is to myself. He asks (1) whether Shakespeare was not a grander creation than a myriad suns? (2) whether the New Testament is not greater than Shakespeare? and (3), "as to miracles," whether I have never heard that warts have been miraculously cured (citing a case in which a clergyman was converted from the errors of his ways (in regard to warts) by the success of "charms" devised by a drunken and disreputable member of his flock). Not in the least knowing what he (or she) may be aiming at in applying the Socratic method with these three questions, I draw my bow at a venture in demanding, by way of reply, (1) whether Euclid was not a grander creation than the solar system? (2) whether a stained window by Burne Jones is not greater than Homer? and (3) as to evolution, whether my correspondent has never heard that Pat's caubeen has been evolved from the cocked hat of the seventeenth century? I trust this may be of use to my correspondent, but I cannot tell; I hope so, I am sure.

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A correspondent asks whether he may, "with a mind fresh from any preconceived ideas, and therefore unpledged to any particular theory," suggest that, owing to the greater mass of the earth, the lighter matter, "such as oxygen and hydrogen," &c., would go to the earth while the denser matter would be all that the moon could collect? One may suggest anything—especially with a mind fresh from any bewildering study of previous researches and inquiries. But this particular theory, that if two neighbouring bodies of different mass were gathering up material the larger would sift out the lighter elements, leaving the smaller to collect the denser, will really not do.

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I do not undertake to consider here all such ideas as may be propounded in letters; but it seemed to me worth while to notice that the state of unpledged freshness, which my correspondent seems to think favourable to the conception of sound ideas has never yet proved trustworthy. *No one has ever discovered any new truth of importance who has not carefully mastered pre-existing knowledge of the department of science to which the truth belongs.*

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A remarkable passage from a paper called *The Christian* has been sent me for my opinion. It says that though there was a "fine tone of candid appreciation of the evolutionary philosophy" at the Birmingham meeting of the British Association, "there was a clear divergence from its extreme conclusions." It proceeds to say of certain remarks uttered by the President of the Anthropological Section, that "they go far to sustain the language of Sir William Dawson in a paper published this year, that the ordinary received chronology of about four or five thousand years for the post-diluvian period, and two thousand years or a little more for the antediluvian period will exhaust all the time that geology can allow for the possible existence of man." I am asked what I suppose would be the opinion of science on this amazing statement, and whether Sir W. Dawson is a high authority on such matters.

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It would be idle to reason about a statement which flatly contradicts everything that palæontology, biology, anthropology, ethnology, philology, archæology, and associated sciences say on the subject of the antiquity of man. No one, however, who has read what Sir W. Dawson has written about evolution can wonder at anything he may have said "this year" on that particular subject. At Birmingham, I believe, he kept within his own ground, and though geologists differ widely from much that he said about the Atlantic basin, while events closely following knocked incontinently on the head the geological opinions he had most confidently expressed, his views on matters simply geological are always worth considering. But a man may be skilful in certain departments of geology, who cannot or will not grasp the meaning of any facts outside, and every one who knows Sir W. Dawson's record must be well assured that if he saw directly before him evidence which would be likely to make the views of Darwin seem acceptable to him, he would go miles round rather than continue on his direct way.

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Yet I find it after all difficult to believe that even Sir W. Dawson—bigoted though he is in his hatred of Darwinism—would have said what the *Christian* attributes to him. Nobody can know much better than he can (if he will) that (1) palæontology has proved the existence of man for at least 100,000 years; (2) biology shows that the race of man as it exists now could not possibly have arisen from the in-and-in breeding of the descendants of two persons four or five thousand years ago (without a series of miracles extending over many generations); (3) anthropology and ethnology emphasise this argument by the evidence they supply as to the varieties existing in the human race and among different nations; (4) philology enables us to recognise periods many times longer than the four or five thousand years spoken of, as necessary for the development of the existing types of language; (5) archæology indicates the existence of races in widely separated parts of the earth, who were so numerous (to say nothing of their advance in civilisation) at a period separated by but a few hundred years from the time assigned to the flood, that the idea of their being all descended from two persons within that time is simply childish; and (6) history shows us the great nations of old existing in their millions when, were that account of the origin of the human race correct, there could not have been five thousand persons living all over the fifty millions of square miles of land surface on our planet. But it seems idle to talk about matters so well known, respecting which there has long been but one opinion among all who are in a position to form an opinion at all.

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The heel of the negro would not have been developed from straight-heeled ancestors, or the heel of the Caucasian from ancestors heeled like the negro, or the two forms severally developed from ancestors with any intermediate degree of backward curvature in the heel, in ten times the period named by the *Christian*.

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The Rev. Mr. Talmage, whose singularly unpleasant preaching (in which ulcers and sores are the favourite forms of imagery) seems to find favour in America, has finally found an argument for the overthrow of what he has characteristically called the "putrid" theory of evolution. "The survival of the fittest," he says. "Yes, the fittest always survives, does it not? Guiteau, the murderer, survived Garfield, our good President, for several months. Of course, Guiteau must have been the fitter of the two. So, at any rate, say Darwin and Huxley and Spencer, for they tell us the fittest survive."

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The same earnest preacher (terms 500 dols. per sermon) deems it not blasphemous to rebuke blasphemy thus:—"A wretch half maddened by the delirium of drink raved against God the other day in the fields; rebuked by his neighbours he grew bolder in his denunciations, proclaiming that if God appeared there to punish him, he, the wretched drunkard that he was, would whip the Almighty. Then was God's wrath aroused against that man. Smoke came from his mouth. Those who had heard him blaspheme drew near to watch him breathing out fearful flames, and shrieking in the agony justly inflicted by an angry God. The blasphemer perished, slain with fire by the God he had offended." Of course, no such event as this really happened. Mr. Talmage is not a truthful man. But if a man had died under such circumstances, would it not be as blasphemous to impute the manner of his death to an allwise and infinite Being, as it would be to impute to God's special will the crime of some murderer, or the misconduct of this poor wretch himself? If we should think meanly of a man who, being insulted by a helpless drunkard, should beat him into the gutter, what are we to think of a man who attributes to God what we should thus despise in a man?

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The world may be divided, so far as ethical religion is concerned, into three great classes:—

First, those who think "This is *my* duty;"

Secondly, those who say "This seems *our* duty;" and

Thirdly, those who teach "This is *your* duty."

Usually the first class do what they think their duty: the second, with a wider sense of duty, try to fulfil it; the third are apt to be so intent on the inquiry whether others do their duty as to have little inclination left for attending to duty themselves. *Medio tutissimus ibis*; the middle class of the three is the best, though much may be said for the first. Distrust the third.

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I fear the Bishop of Carlisle will be attacked in lively fashion for his article in the *Contemporary Review*, in which he adopts much the same view of the connection between the seven days of the week and the seven planets as I have indicated in my articles on "The Unknowable." Still less will it be liked that he should advance as possible what science has long since recognised as certain, that the Genesis cosmogony is but a speculation, and as certain what science has long since recognised as obvious, that it has no scientific value. But he falls into error in describing the interval between full moons as 28 days, and therefore asserting that there are more nearly 13 than 12 lunar months in a year. There are 29·54 days in a lunar month, and 12 such months cover 354·5 days.

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From a clerical correspondent I have received a letter courteously inviting me to say what I believe in regard to the "Josephus question." "You should go on," he says, "to tell us what you believe to be a correct account, so that we may judge whether we are not thereby landed in greater difficulties than meet us in accepting the orthodox account." Here the word orthodox manifestly bears only its conventional meaning, for orthodox used in its correct meaning would involve a *petitio principii*.

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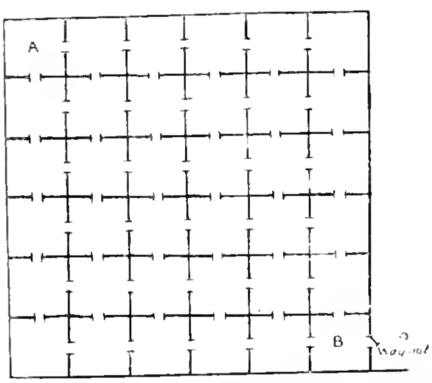
I originally presented the "Josephus question" as an "historical puzzle," and, unlike the puzzles which are now appearing monthly in these columns, it is not one to which I have undertaken to give a solution. If I had I might have found myself much worse "put to it" than I did when coming to the problem of the sixteen whist-players who were to have five sittings without any two ever being at the same table: I found I could not get a solution quite so quickly as I had expected. I felt sure when I asked that question that there must be a solution, and I supposed there would be no difficulty in finding it; but it took me longer than I cared for: and only the sense of duty to readers, who might have failed, and who would expect the propounder of the puzzle to solve it for them, caused me to work the puzzle out. The Josephus puzzle, or rather the general puzzle, of which that particular perplexity is a part, might more aptly be compared, perhaps, to such a puzzle as the following, which *I believe* has a solution, but what that solution may be I by no means promise to tell—for a most excellent reason:—



The figure represents the plan of a prison with intercommunicating cells (bless the Latin); a prisoner in A is offered his freedom if he can make his way to B after passing once, and once only, through all the 36 cells. How is he to do it?

* * *

I have in this matter of the historical and theological puzzle most carefully limited my statements to matters of fact, avoiding all expression of opinion. Such facts as are certain and admitted I have stated as such; where there is doubt I have indicated the nature of the doubts. I have indicated no inferences. If any consider that the *facts* point very definitely in a certain direction in which they would rather not look, that highly illogical (but very common) state of mind is a phenomenon which interests me as a student of science, and of human nature as a department of science; but I am no more responsible for such disquiet than I am for the inherited mental or moral qualities from which it takes its rise. If, on the other hand, others consider that the facts have no such significance, I have asserted nothing to the contrary. Facts can always be studied with advantage by lovers of knowledge (with a small "k"): when they are rightly interpreted they tend to the increase of Wisdom (with a capital W): but whether for the moment they can be rightly interpreted or not, they cannot safely be neglected.

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I propose to sum up in the next number matters of fact bearing on this question—noting that in various parts of the last volume of Knowledge these points have been dealt with in detail, and, so far as I know, scarce any of them have been regarded as open to doubt, let their interpretation be what it may.

Reviews.

Life Histories of Plants. By Prof. D. McAlpine. (Swan Sonnenschein & Co.)—This is an extremely interesting book, the most important section of which, that dealing with the comparison of plants and animals on a physiological basis, deserves careful study. The author, wisely following the newer and sounder methods, lays stress upon the subordination of form to function, treating of the organism as a living thing whose work determines the mechanism. For the organ was made for it—not it for the organ. Did space permit, we should like to quote the author's admirable remarks on this matter, but we shall render both him and our readers kindlier service by urging the perusal of the book itself. The diagrams, especially that on p. 23, are even more helpful to clearer understanding of the text than the woodcuts.

Our Island Continent: a Naturalist's Holiday in Australia. By Dr. J. E. Taylor. (S. P. C. K.)—In this little book the author, who is well known as a writer of agreeable books on botanical and kindred subjects, narrates his impressions of a first visit to a land in which, as he happily puts it, the naturalist who is also a geologist may feel himself living in the Secondary Epoch, certain typical life-forms of which flourish there to this day. The geological history of Australia is admirably and clearly summarised, but when dealing with the fauna of the country we are surprised to find Dr. Taylor betraying ignorance of Mr. Caldwell's discoveries concerning the earliest mammalian forms in speaking of the marsupials as "the first mammals to be created." We suppose, apart from the error in this statement, that the form of its presentment is a concession to the weaker brethren of Northumberland Avenue, who still cling to the old notion of the immutability of species.

The Literature of Local Institutions. By G. L. Gomme. (Elliot Stock.)—The able and indefatigable Director of the Folk-Lore Society has made the subject to which this book is a convenient introduction his special study, and now that the reform and expansion of local government are imminent, he does good service in enlightening us concerning the origin and growth of the autonomous bodies which pulsated with vigorous life in shire and hundred and township, and which have made England the nursing-mother of free institutions and the successful coloniser alike in torrid and temperate zones. We advise all persons interested in municipal government to buy Mr. Gomme's work.

Horticultural Buildings. By F. A. Fawkes. New Edition. (London: Swan Sonnenschein, Le Bas, & Lowrey. 1886.)—The possessor of a garden must suffer woefully, either from lack of enthusiasm or from impecuniosity, who is content to do without "glass" in some form, however humble, in it. To anyone and everyone who may be desirous of possessing so necessary an adjunct, be it in the form of the humble garden-frame or of the lordly conservatory, Mr. Fawkes' book will be found a perfect mine of information. Not only does he tell the incipient horticulturist what to do, but also why to do it, theory and practice running *pari passu* throughout the volume. To such an extent is this carried that the work opens with a description of the cause of the seasons and a detailed account of the various angles to be adopted for the "pitch" of greenhouse roofs in different latitudes, so as to obtain the maximum heating effect from the sun's rays. The question of iron *v.* wooden houses is thoroughly discussed, and the whole of the leading existing systems of glazing equally thoroughly described. The subject of heating, too—that *bête noire* of the beginner—is exhaustively examined and explained. In fact, it is not too much to say that anyone previously ignorant of the subject might, after a careful perusal and mastery of the treatise before us, confidently design and supervise the erection of any forcing-frame, greenhouse, wall-tree protector, or conservatory ever likely to be required by the overwhelming proportion of those into whose hands it is likely to fall. There is also a chapter on meteorology and meteorological instruments; another on the law in connection with gardening erections, and so on. In fine, we may say, shortly, that no gardening library, country or suburban, can be held to be complete which does not contain Mr. Fawkes' excellent and painstaking volume. We may add that it is profusely illustrated.

Plane and Spherical Trigonometry. In Three Parts. By H. B. Goodwin, M.A. (London: Longmans, Green, & Co. 1886.)—The work before us is a compilation, made under the sanction of the Lords of the Admiralty, for the use of the junior officers of the Royal Navy, and is designed to supersede the somewhat heterogeneous collection of text-books hitherto in use in that branch of the service. From his very considerable experience as a naval instructor Mr. Goodwin has doubtless not adopted the arrangement which characterises the present work without the most careful consideration of its applicability to the purposes for which it is especially designed. It seems, however, to us to suffer under the defect of all recent books on trigonometry—we mean that of treating its subject in too abstract a manner for the very beginner. We cannot help feeling that the modern fashion of dealing with the trigonometrical ratios, the defining sine and cosine in a particular way, and deriving all the rest from them, is scarcely the way to give the incipient student an *intelligent* idea of what he is endeavouring to master. The old-world reference to the circle, with its visible connection with the angular functions, certainly does show to what and of what certain lines are tangent and secant, &c., &c., as the case may be; and this idea once grasped, subsequent study is made much smoother and easier. It also seems to us that trigonometrical analysis generally is introduced full early into the work under review, though this mode may possibly have been adopted from practical experience of its utility. Our remarks refer rather to the manner in which our author has arranged his material than to that material itself, and must be held to apply strictly to the first division of the book, that on plane trigonometry; the second part—that on spherical trigonometry—is excellent both in matter and manner; while the concluding or practical section may be mentioned with equal praise. In fact, for fulness, lucidity, and appositeness, as far as the large mass of examples is concerned, this leaves nothing whatever to be desired. In addition to the short list of errata on a slip inserted in the volume, we may note that on pp. 10, 26, and elsewhere the lines dividing the numerators and denominators of fractions have slipped out; that on p. 71 the log. of ·00527 is printed as 3·721811, which should, of course, be $\bar{3}$·721811; and that in example 20 on p. 224 "declination" appears where latitude is obviously intended. Such microscopic blemishes as these, however, can scarcely be held to detract from the value of a book which may be confidently recommended to all who desire to master the application of trigonometry to nautical astronomy and terrestrial surveying.

Liste Générale des Observatoires et des Astronomes, des Sociétés et des Revues Astronomiques. Par A. LANCASTER. (Brussels: F. Hayez. 1886.)—This is intended as a kind of directory of all persons and institutions connected mediately or immediately with astronomy, but it seems to us to be susceptible of considerable improvement. Names of absolutely unknown men have crept in, together with those of dead ones (such as Mr. C. E. Burton and Mr. R. C. Carrington) of more eminence; while, in the list of instrument makers, Simms is omitted altogether! On page 92 occurs the sole note appended to any name in the list, and, with reference to the one which does appear there, we must say that unless it was inserted by the request and with the sanction of the gentleman to whose name it is attached, (which we find it impossible to believe), we can only think that M. Lancaster has been guilty of a piece of very gross impertinence indeed.

The English Illustrated Magazine, 1886. (Macmillan & Co.)—There is no falling off either in the illustrations or letterpress of this excellent serial, which, with its four complete novels, one of which is from the vigorous pen of Mr. Christie Murray, and another from the delicate pen of Miss Veley, and its miscellaneous papers, makes well-nigh the welcomest, certainly the cheapest, gift-book of the year. Creditable to the taste and judgment of its conductors is the prominence given to insular and rural subjects, with their beautiful woodcuts of our old seaports, and of commons which are happily safe from the land-grabber.

Merciful or Merciless, by STACKPOOL E. O'DELL (London: T. Fisher Unwin, 1886), is a novel which should be read by all those who are inclined to take a desponding view as regards the future life. The book is entirely directed against the belief in everlasting punishment after death; but its strong appeals, both to the feelings and to the logical faculty, are so skilfully interwoven with the very interesting plot and with a variety of incidents that no odium whatever can be attached to it as what "Ouida" calls "that misguided thing, a novel with a purpose." The hero, George Graystone, having been overtaken by a storm when out at sea with his little companion, Florence Harper, is separated from her and picked up by a passing vessel, leaving her and all his friends in Daffydale, a village near Ventnor, to mourn him as drowned. This incident introduces the theme of the book, as Mrs. Harper believes that the boy's soul has been lost, owing to his want of faith in the doctrine as to salvation preached by her favourite minister, Mr. Heron. Florence, however, breaks away from this gloomy creed, unwilling to believe that a merciful God can doom any soul to an eternity of torture. George Graystone, who has been picked up, suffering from injury to the head, owing to the concussion of his canoe with the rescuing steamer, is carried to New Zealand, and in the hospital at Auckland he recovers, but with the loss of the memory of all his former experience, having to be re-taught to speak, read, and write. His name being unknown, he has been given that of the ship in which he arrived, "John Hammond," and this he unquestioningly adopts. Cases such as his are by no means unknown in the annals of psychological medicine, and the whole delineation of this character is skilful. Having grown into a strong man, he meets by chance with his former companion, Jim Harper, who has come to New Zealand to try his luck, since the family has grown poor under the religious extravagance of Mrs. Harper. The two make friends without recognising each other, and succeed in discovering and pegging out claims on a goldfield, which makes them both rich men. The excitement of sudden wealth is, however, too much for Jim, and he falls ill. While he is thus prostrated, he receives a letter from Florence to the effect that their mother has mortgaged their home, "The Petrel," in order to build a chapel for Mr. Heron, and that the house in which they were born will have to be sold. Jim being too ill to move, Hammond goes to England to stop the sale. He meets his father, Sir James Graystone, in the train going down to Daffydale, and the old gentleman is attracted to him, owing to his likeness to his son. They, however, quarrel when each discovers that the other's business is to buy the "Petrel." On coming amidst the scenes of his childhood, George Graystone's memory gradually revives, and his cure is completed by the sight of Florence, his child-sweetheart, whom he eventually marries. All thus comes right in the end, the old baronet recovering his heir, and the young heroine her lover, and everyone attains the conviction that God is "merciful, not merciless," even the preacher, Mr. Heron, seceding from his gloomy faith. He is led to do this by the knowledge of the evil it produces, and decided by the death of one of his congregants. "I was with her to the last," he says. "I always looked upon her as one of the most religious persons who went to my chapel, but her deathbed was terrible. Up to the last moment of her life she had a dreadful fear that she had committed the 'unpardonable sin'; that she was an outcast from God, predestined by Sovereign Will to be everlastingly lost. To her mind devils were awaiting her last breath, in order to drag her down to hell. Her agony was frightful. This deathbed made me think as I never thought before concerning the effects of our theology, so I decided not to preach it again—at least not the portion of it that relates to everlasting punishment." It is a pity that many a clergyman in real life should not take warning from cases such as these, with which each preacher of this ghastly doctrine must frequently meet. A religion which serves to render a deathbed a scene of horror instead of one of peaceful resignation does not deserve the name of religion —a creed which serves to people our madhouses as this does, and represents the Deity as the most cruel of tyrants, should be banished for ever, and its teaching regarded as a crime.

The Silence of Dean Maitland. By MAXWELL GRAY. (Kegan Paul, Trench & Co.)—The gap among novelists of the first rank caused by the death of George Eliot remains unfilled. A few promising candidates are in the field, but as yet their works have not justified their election, and they have now to face the imminent risk of being passed by the authoress (for surely only a woman could have written it) of this powerful and pathetic story. If the high level which it reaches at a bound is maintained, and its success does not tempt Maxwell Gray to "walk into the parlour" of the publisher with any less matured work, her high place is assured. Never, in our judgment, have the refined and illiterate, yet shrewd, types of English rural life been more skilfully depicted; there is not a lay figure in any of the characters the tragedies of whose lives compose this drama, and we take reluctant leave of them as of men and women known in the flesh. For vivid and delicate description we can recall nothing of its kind which excels, and little that equals, the scene in the opening chapter, when Alma Lee, leaning wearily on the gate and watching the waning of the grey afternoon, hears the music rung out from the tiny bells that tinkle on the nodding heads of Farmer Long's team as it drags the massive waggon up-hill. What shame and sorrow the on-coming days brought her; what blight fell on innocent lives, killing high ideals, through the silence which Dean Maitland broke only when the wrong done was irreparable, our readers must learn for themselves. Ingenious as is the plot, and unflagging as it is in interest, the book is not to be read for that alone, but also for its charm of presentment and wholesomeness of tone.

The Life and Labours of John Mercer, F.R.S., F.C.S. By Edward A. Parnell, F.C.S. (London: Longmans, Green, & Co. 1886.)—Mr. Parnell has produced a biography absolutely *sui generis*. His book very largely consists of recipes used at the Oakenshaw Calico-printing Works, chapters descriptive of the processes there employed being connected by a slender thread of narrative of a few incidents in the uneventful life of the guiding spirit there. Mercer was undoubtedly a remarkable instance of a self-taught scientific man who rose from the ranks, such eminence as he achieved mainly belonging to the earlier half of the century. This "Life," however, will be chiefly found valuable by those engaged in the occupation which he so successfully followed. By far the most interesting part of it to the general reader appears under the heading of "Thoughts on Mould, and Preparations for the Cholera," whence it seems that as early as 1843 Mercer advanced a germ-theory of disease, of which the current microbe doctrine of Pasteur and Koch is only a development.

Solid Geometry. By Percival Frost, D.Sc., F.R.S. Third edition. (London: Macmillan & Co. 1886.)—The mathematician will welcome this new edition of the familiar "Treatise on Solid Geometry," of Frost and Wostenholme. In his preface to the second edition Dr. Frost deplored the loss of his coadjutor's aid; but, without in the smallest degree intending to depreciate the value of Mr. Wostenholme's co-operation, we cannot say that the result of Dr. Frost's unaided exertions leaves anything to be desired. For lucidity, exhaustiveness, and thoroughness of exposition, the work in its present form may well challenge comparison with any one extant. We note that Dr. Frost—as it seems to us with a great show of reason—persists in designating the locus for the equation of the second degree (more commonly known as "quadric") as "conicoid." It may suffice to show that the most rigid application to the study of the higher mathematics by no means necessarily crushes out the sense of the humorous if we quote a few words from those in which our author justifies his nomenclature. "I consider," he says, "that the surface of the second degree at present, whatever may be the case in some future development, stands on a platform of its own on account of the services which it has rendered to all departments of mathematical science, and well deserves a distinctive name instead of being recognised only by its number, a mode of designation which, I am informed, a convict feels so acutely. Man might be always called a biped, because besides himself there exists a quadruped, an octopus, and a centipede, but on account of his superiority it is more complimentary to call him by some special name." The book has obviously been very carefully read for the press.

The Chemistry of Wheat, Flour, and Bread. By William Jago, F.C.S., &c. (Brighton, 138 Springfield Road: The Author. 1886.)—Mr. Jago has produced what may fairly be termed an encyclopædia of milling, breadmaking, and baking, which will be found alike useful to the practical baker and the technological chemist, to say nothing of the ordinary consumer who may feel interested in the composition of "the staff of life," and desire to know somewhat of its composition and the method of production, and to be able to detect adulteration in it where it exists. The chemistry of the subject is exhaustively treated, and a full description is given of every baking process at present in use. The analytical portion of the book may be particularly commended. A chapter is given on the moulds and fungoid growths which attack wheat and flour; in fact, nothing of the slightest interest is omitted in connection with the subjects on which the volume treats. Mr. Jago has done his work well.

Cæsar: a Sketch. By J. A. Froude. (Longmans.)—Perhaps the most striking parts of this book, the cheaper reprint of which is welcome, are in the earlier chapters, with their parallels between Roman and modern society, especially in the decay of old beliefs, to the outward and visible forms of which a seeming respect is paid. As to the fidelity of the portrait of the great leader which is sketched in Mr. Froude's matchless prose, opinions will differ, as they differ about aught else that he has written, but in lesser degree as the materials for the sketch are imperfect and remote. There can, however, be no diversity of judgment on the skill with which those materials are woven together, nor on the vivid presentment of the man whose character Mr. Froude has, we think, assessed accurately and impartially.

Boy's Own Stories. By Ascott R. Hope. (T. Fisher Unwin.)—Mr. Ascott Hope is one of the few writers of books for boys who has a worthy ideal in fulfilling his vocation. The tone of all his works is refined and wholesome, and he has withal the rare merit of never repeating himself, not only because his own ideas run in no narrow groove, but because he takes pains to go far afield for the materials for his stories. He has, in the present volume, gathered these from both hemispheres, and had the good fortune to unearth some original autobiographies—narratives of peril and adventure, which cannot fail to interest his audience. Diverse as are the sources from which these are gathered, the book has a unity of purpose and subject, and, whilst the opening tale introduces us to tragic scenes from the Reign of Terror, the closing tale is founded on an enthrilling and affecting incident of the later Revolution which Mr. Hope has adapted from a little-known reminiscence of Jules Simon.

We have received the concluding part of Messrs. Hudson and Gosse's superb and exhaustive monograph on the *Rotifera, or Wheel Animalcules* (Longmans); also the current issues of Mr. Teall's *British Petrography*, to which we hope every student of that branch of the science is subscribing; and of Mr. Cole's *Studies in Microscopical Science*, which maintains its high character. Messrs. Cassell send us a *School Bank Manual*, by Agnes Lambert, which is terse and to the point; a new edition of Morell's *Guide to Employment in the Civil Service*, the best book extant as an aid to candidates in choosing a department of the Service and in hints as to success; and a second edition of Miss Buckland's *Story of English Literature*. This is a good introduction to study of the more elaborate works of writers like Professor Morley, and may conduce to the selection of some period of which full knowledge is more instructive than any skimming of so vast a subject can be. But the space given to the older writers has compelled too meagre treatment of the moderns.

Microscopists may be interested in the following:—The whole of the scientific effects of the late Dr. John Matthews, Vice-President of the Quekett Society, will shortly be sold at Stevens's Rooms, King Street, W.C.

Mr. Medland, of the Borough, has designed an ingenious and compact box, which, within the portable compass of 10 inches length and 4 inches width, contains sixteen trays, in the flaps of which 144 slides can be well and safely packed, any slide being easily withdrawn by opening the fall-back side with which the box is fitted. It is made of polished pine, costs 7s. 6d., and is the best and cheapest thing of the kind that we have seen.

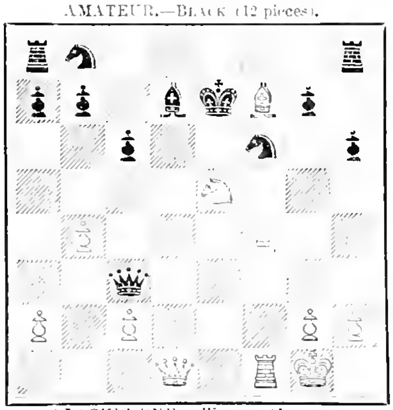
Our Chess Column.

By "Mephisto."

A FEW EXAMPLES OF BLACKBURNE'S SKILL.

GAME-ENDING.

AMATEUR.—Black (12 pieces).



BLACKBURNE.—White (11 pieces).

The following is an ending of a game Mr. Blackburne played at the Manchester Chess Club with an amateur. He gave the odds of the Queen's Rook. We append the moves of the brilliant finish:—

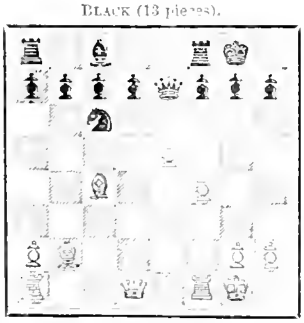
1. B to QKt3	R to K sq.	3. Kt to B7 (ch)	K to K2
2. Q to Q6 (ch)	K × Q	4. B to Q6 mate.	

The following very pretty game is one of eight played blindfolded and simultaneously by Mr. Blackburne at the Manchester Chess Club:—

(Danish Gambit.)

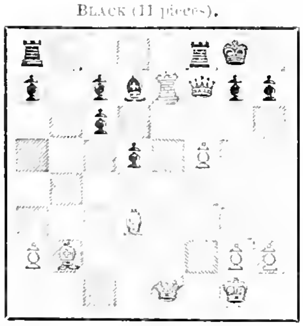
White. Blackburne.	Black. C. Brevig.	White. Blackburne.	Black. C. Brevig.
1. P to K4	P to K4	14. R to B sq	Kt to R4
2. P to Q4	P × P	15. B to Q3	P to Q4
3. P to QB3	P × P	16. P to B5	P to KB3
4. B to QB4	P × P (a)	17. R to K sq	P × P
5. B × P	Kt to KB3	18. R × P	Q to B2
6. Kt to QB3	Kt to B3	19. Q to K sq	Kt to B3
7. Kt to B3	B to Kt5	20. R × Kt (c)	P × R
8. Castles	B × Kt (b)	21. R to K7	B to Q2 (d)
9. B × B	Castles		
10. P to K5	Kt to K5		
11. B to Kt2	Kt to Kt4		
12. Kt × Kt	Q × Kt		
13. P to B4	Q to K2		

Black (13 pieces).



White (11 pieces).

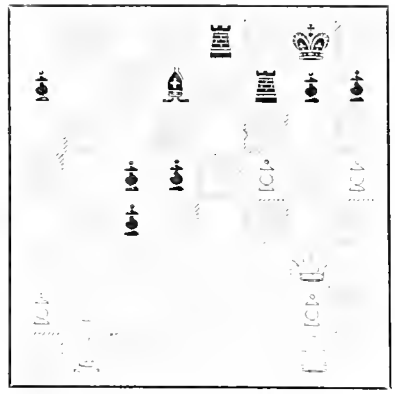
Black (11 pieces).



White (9 pieces).

22. R × Q	R × R
23. Q to Kt3	R to K sq
24. P to KR4	P to B4
25. P to R5 (e)	P to B5
26. B to Kt sq	P to B4

AMATEUR.—Black (10 pieces).



BLACKBURNE.—White (8 pieces).

27. P to B6 (f)	P to Q5	30. P to R6	R to K8 (ch)
28. B × P (ch) (g)	K × B	31. K to R2	B to K3
29. Q to Kt6 (ch)	K to Kt sq	32. BP × P, and Black cannot avert mate beyond four more moves.	

NOTES.

(a) This constitutes the Danish Gambit. The two White Bishops are very strongly posted. The chief danger lies in White advancing his P to K5, thereby blocking Black's game.

(b) Black would not derive any benefit from playing 9. P to Q3 instead of 9. B × Kt, for White would reply with 10. Kt to Q5, in which case Black could not play Kt × Kt on account of 11. P × Kt, followed by 12. Q to R4 (ch), winning a piece.

(c) Very cleverly designed, especially if we consider that White must have foreseen some such chance by playing his QR to B sq.

(d) Compelled to give up his Queen, as otherwise Black would be mated.

(e) Planning a very ingenious attack. Black is vainly endeavouring to cut off the commanding diagonal of White's QB by attempting to fix his P on Q5.

(f) Preparing a very pretty combination.

(g) Very pretty.

Another blindfold game played on the same occasion:—

(Allgaier-Thorold Gambit.)

White. Blackburne.	Black. I. G. Boulaye.	White. Blackburne.	Black. I. G. Boulaye.
1. P to K4	P to K4	15. B to Q1	R to B sq.
2. P to KB4	P × P	16. P to B5	Kt to R sq
3. Kt to KB3	P to KKt4	17. B × KtP	P to R4 (c)
4. P to KR4	P to Kt5	18. B × B	Q × B (d)
5. Kt to Kt5	P to KR3	19. Q to B3	R to R3
6. Kt × P	K × Kt	20. P to Q6 (e)	R × P
7. P to Q4	P to Q4	21. Kt × R	P × Kt
8. B × P	P × P	22. QR to K sq	Q to Q2
9. B to K2 (a)	Kt to KB3	23. Q to B5	Q to Q sq
10. Kt to B3	Kt to B3 (b)	24. R to B3	R to B2
11. P to Q5	Kt to K2	25. R (B3) to K3	K to Kt sq
12. Castles	Kt to Kt3	26. B × Kt (f)	R × B
13. B to K3	B to K2	27. Q to Q5 (ch)	Kt to B2
14. Kt × P	K to Kt2	28. R × B and wins	

(a) A change from the usual proceedings; in its favour may be said that it leaves Black's K on the B2, where he is less safe than on Kt2.

(b) Here B to Q3 seems better.

(c) Played in the vain hope of being able to afford some protection to Kt by R to R3.

(d) If, instead of this, R × B, White will win a piece by 18. Q to Kt5 (ch), followed by 19. Kt × Kt &c.

(e) There is no answer to this move.

(f) Winning a piece.

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WHIST.

By "FIVE OF CLUBS."

THE following game is from the *Westminster Papers*, and was recently selected as a good illustrative hand for the whist column of the *Australasian*:—

THE HANDS.

B { S. (*trumps*).—A, 2, 4, 9. H.—A, 4, 6. C.—Kn, 5, 10. D.—5, 6, 8. }

Y { S. (*tps*).—K, Q. H.—K, Q, 7, 10. C.—A, Q, 2, 3, 8. D.—A, 10. }

B

Y Z

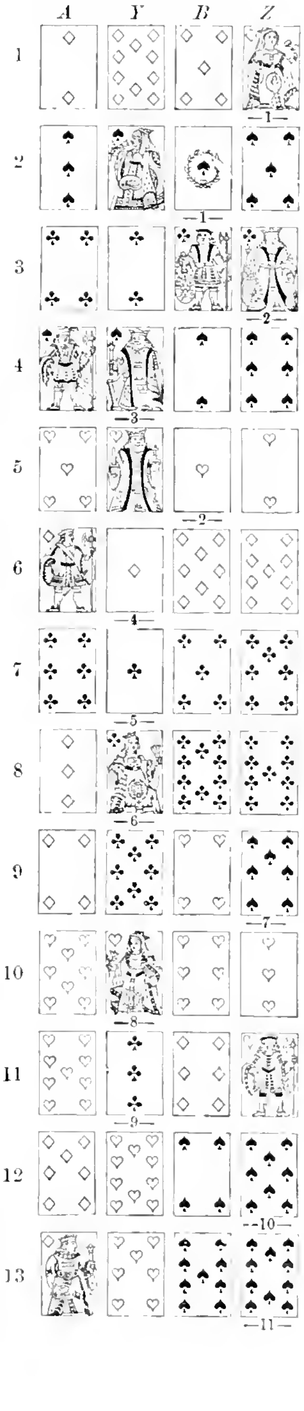
Tr. S. 7

A leads.

Z { S. (*tps*).—5, 6, 7, 8, 10. H.—Kn, 3, 2. C.—K, 7, 9. D.—Q, 9. }

A { S. (*trumps*).—Kn, 3. H—5, 8, 9. C.—4, 6. D.—K, Kn, 2, 3, 4, 7 }

A B play against *Y* and *Z*. Score: *A B* three; *Y Z* love.



NOTES ON THE PLAY.

Card underlined wins trick; card underneath leading next.

1. The usual lead now is the fourth best — the so-called American lead. As the cards lie, *Y Z* would have lost nothing had *Z* passed his partner's trick. But he had to play a forward game, the chances being that *A B* were two by honours.

2. The spade six would now be commonly played.

3. Better return his partner's suit.

4. *Y* can now place Spade four and another Spade in *B*'s hand, whose lead at trick 3 spoke plainly of four trumps. Therefore,

7, 8, 9, after making two of his winning Clubs, *Y* goes on with them, leading through *B*'s probable minor Tenace. *B* of course lets the Club pass through a winning card. *Z* must either take this Club or the Three. If he passes both, he will have to take the 11th trick, and *B* will make his Spade nine.

12, 13. *Y Z* wins the game.

MATHEWS ON WHIST.

Our column of Whist strategy from Mathews is crowded out this month.

THE FACE OF THE SKY FOR DECEMBER.

By F.R.A.S.

NEVER more than 15° high even at noon, and shrouded in the mists of winter, the sun now is seen with difficulty, even when visible at all. On the 21st (the shortest day) he is only above the horizon of London for 7h. 44m. The night sky is portrayed in map xii. of "The Stars in their Seasons." Minima of Algol (same map) may be observed at 11h. 15m. P.M. on the 6th; 8h. 5m. P.M. on the 9th; 4h. 54m. P.M. on the 12th; 12h. 58m. P.M. on the 26th, and 9h. 47m. P.M. on the 29th. Mercury is a morning star, and travels to his greatest distance west of the sun (21° 52′) on the 22nd; but he is so badly placed that we may regard him as invisible. Venus, also a morning star, is worse placed still. She comes into superior conjunction with the sun (or is behind him) during the early morning of the 3rd. Mars will be invisible for the observer's purpose during the remainder of the year, a remark which applies equally to Jupiter. Saturn rises between 6 and 7 o'clock in the evening at the beginning of December, and about 20 minutes to 5 on the 31st, so that he is visible during a very large part of the amateur's working night. The slight closing up of his rings will be noted. It is travelling towards δ Geminorum ("The Stars in their Seasons," map ii.). Uranus is invisible: but Neptune may still be seen in the barren region in Taurus to the south and (just to the west) of the Pleiades. The moon enters her first quarter at 2h. 25m. P.M. on the 3rd; is full at 9h. 30·2m. A.M. on the 11th; enters her last quarter at 6h. 39·1 A.M. on the 18th; and is new at 9h. 54·7m. A.M. on the 25th. Several stars will be occulted by the moon during December, but four only of such occultations will happen at convenient hours for the student. On the 3rd h^1 Aquarii, a star of the 5½th magnitude, will disappear at the dark limb of the moon at 5h. 8m. P.M., at an angle from her vertex of 116°. It will reappear at her bright limb at 6h. 30m. P.M., at an angle of 286° from her vertex. On the 10th, B.A.C. 1526, of the 6th magnitude, will disappear at the dark limb at 10h. 29m. P.M., at a vertical angle of 78°; to reappear at the bright limb at 11h. 44m. P.M., at an angle of 292° from the moon's vertex. On the 14th, 54 Cancri, of the 6½th magnitude, will disappear at the bright limb at 9h. 26m. P.M., at an angle from the vertex of the moon of 85°. It will reappear at 10h. 9m. P.M., at the dark limb at an angle of 181° from the vertex. Lastly, on the 28th, 29 Capricorni, a 6th magnitude star, will disappear at the dark limb at 6h. 31m. P.M., at an angle of 159° from the lunar vertex; but the moon will have set ere it reappears at her opposite limb. At noon, on December 1, the moon is on the confines of Capricornus and Aquarius ("The Seasons Pictured," plate xxi.), and is subsequently travelling through Aquarius until 7h. 30m. A.M. on the 4th, when she enters Pisces ("The Seasons Pictured," plate xxii.). In her journey through Pisces, she arrives at 1 P.M. on the 7th at the northern corner of Cetus; by 3 o'clock the next morning she has traversed this and entered Aries. She is in Aries until 6 A.M. on the 9th, when she quits it for Taurus ("The Seasons Pictured," plate xxiii.). As she passes across Taurus she reaches, at 9h. 30m. P.M. on the 11th, the boundary of the northern outlier of Orion. This she crosses in 11 hours, and at 8h. 30m. A.M. on the 12th emerges in Gemini ("The Seasons Pictured," plate xxiv.). She remains in Gemini until 1 A.M. on the 14th, when she quits it for Cancer; leaving Cancer in turn for Leo at noon on the 15th. She occupies until midnight on the 17th in passing over Leo, and, at the hour just named, crosses the boundary into Virgo ("The Seasons Pictured," plate xxv.). It is 1 A.M. on the 21st ere her journey through Virgo is accomplished and she has passed into Libra ("The Seasons Pictured," plate xxvi.). Here she remains until 9 P.M. on the 22nd, when she reaches the narrow northern spike of Scorpio. By 6 o'clock the next morning she has passed through this and entered Ophiuchus. At midnight on the 24th she leaves Ophiuchus for Sagittarius; as she does Sagittarius for Capricornus at 10h. 30m. A.M. on the 27th ("The Seasons Pictured," plate xxi.). At 6h. 30m. P.M. on the 28th she quits Capricornus for Aquarius. She continues in Aquarius until 4 P.M. on the 31st, when she enters Pisces, where she of course remains when these notes terminate.

KNOWLEDGE

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THE BEGINNING OF CHRISTIANITY.

By RICHARD A. PROCTOR.

IN the following summary of facts and expression of opinion I reply to the question addressed me, as mentioned under "Gossip" in the last number of KNOWLEDGE, by a courteous clerical correspondent :—

First, it is simply a fact (be the explanation what it may) that not one of those writers, and notably neither Josephus nor Philo—who might have been expected to record many of the most remarkable events associated with the life of Jesus the Christ (or Anointed) in the Gospels according to Matthew, Mark, Luke, and John—make any mention of those events, though several were such as belong to the domain of history. Accepting even all the passages which have long been recognised as interpolations (some of them of the clumsiest sort), this remains true. Nay, if such passages are accepted, the difficulty is considerably increased.

Secondly, it is simply a fact (be the explanation what it may) that in the two sections of the New Testament which have been shown to have been really written by those whose names are associated with them, viz., the four unmistakably genuine letters of Paul (who had never met Jesus) and the Book of Revelations by John, "the servant of Jesus" (who knew Jesus well, and shows himself strongly—one might almost say fiercely—anti-Pauline), we find scarcely any reference to the details of the life of Jesus Christ. The resurrection is the only point insisted upon by Paul; and, strangely enough, he insists on it in such a tone as to imply that in his time not only the general doctrine of the resurrection of the dead, but the resurrection of Jesus, was disputed by many even in the Christian community. (Paul's anxiety on this point is remarkable, be the explanation what it may.) No light falls on our problem from this quarter. Nor are we helped if we regard all the epistles attributed to Paul as really his, rejecting decisive evidence that some among them cannot have been written by the great apostle of the Gentiles.

Thirdly, it is simply a fact (be the explanation what it may) that all those more remarkable details associated, long after even the fall of Jerusalem, with the history of Jesus the Christ, for mention of which we vainly look in the pages of contemporary writers, are found in the records of solar heroes, or of men to whom, long after their death, the characteristics of the sun-god were attributed—generally among nations who had long since given up, or had even absolutely forgotten, their old sun-worshipping religion. This is true of every such detail, from the Annunciation to the Ascension.

Fourthly, it is simply a fact (be the explanation what it may) that all the miracles described in the New Testament are such as had in old times been always regarded as specially solar. Because the sun brings light, it had been taught that the sun-god causes the blind to see: because the sun restores winter's dead to life, the sun-god raises the dead; because the sun restores sickly and diseased vegetation to health, the sun-god heals the sick; because the sun turns the waters which fall on the earth into the rich juice of the vine, the sun-god turns water into wine; because the sun causes the seeds which fall on the earth to bear fruit, thirty, sixty, and even a hundredfold, therefore the sun-god feeds the world richly out of little; because the sun kills feeble vegetation, the sun-god blasts the barren tree; because the sun rises above the sea-horizon, the sun-god walks upon the water; and because as the sun reappears after the darkness of storm, calm presently is restored, the sun-god stills the tempest.

Fifthly, it is simply a fact (be the explanation what it may) that all the festivals eventually adopted, both in the Eastern and Western Church, are not only related to astronomical events, but still constantly regulated by them —the movable festivals mostly depending on the equinoxes and the moon, while the fixed festivals are associated with the solstices. One might add such peculiarities as the twelve apostles, who like the twelve patriarchs (unmistakably), and the twelve apostles of Gautama, suggest a manifest association with the twelve zodiacal signs or solar months; while the seventy disciples of Christ, like the seventy disciples of Gautama, and divers others sets of seventy, suggest a kindred association with the ancient lunar year of five times seventy days. But the determination of Christian, as of Jewish, Mohammedan, and Buddhist festivals and fasts by the critical phases of the sun and moon, is the fact of profoundest significance.

Sixthly, it is simply a fact (be the explanation what it may) that the natural events related in the four Gospels which were retained (when two score and more were rejected), are in nearly every case found to correspond strangely with events referred to or fully related as actual facts in the writings of Josephus and others; but as facts belonging to the histories of several different persons, not one of whom can be identified with Jesus the Anointed Teacher, though several of them bore the (then common) name of Jesus. Even so strange a circumstance as the crucifying of three persons, of whom two died but the third was restored to life, actually happened to the knowledge of Josephus, who describes the event in the most natural and touching manner, but it happened long after the time of Pontius Pilate, and the three who were crucified were Josephus's personal friends. Indeed, so far as this personal experience was concerned, the historical Josephus of the family of Asamoneus may be said in this story to have filled the part filled in the other by Josephus of Arimathea. Even more perplexing is the reference by Josephus to a man named Zacharias son of Baruch (who was a sort of prophet, inasmuch as "he went over," Josephus tells us, "all the transgressions of the people against the law, and made many lamentations upon the confusion to which they had brought public affairs"), whom the people slew "in the middle of the temple." This happened about thirty years after Pontius Pilate was recalled to Rome—according to Josephus, for condemning to death a man who had led the people out to Mount Gerizim under false pretences, and whose record in this and other respects is quite unlike the history of Jesus, the Anointed Teacher of the Gospels. The strangeness of the story lies in its odd agreement with the reference made by Jesus (according to a much later account than Josephus's) to a prophet (described as *the last* of those slain by the Jews) whom Jesus—according to this account—calls Zacharias, son of Barachias, and "whom," he says, "ye slew between the temple and the altar." Zechariah prophesied five centuries before, and has been apparently mixed up by the narrator (six centuries after the prophet's time) both with a much earlier Zechariah the son of Jehoiada, who was stoned about 840 years before Christ, at the command of King Joash, "in the court of the house of the Lord" (2 Chronicles xxiv. 20 22), and with Zacharias, the son of Baruch, who was slain in the midst of the temple, as related by Josephus, about a third of a century after the death of Jesus the Christ, according to the Gospel record.

Seventhly, it is a simple fact (be the explanation what it may) that the teachings in the New Testament, not only in their ethical aspect, but in method, and often in actual wording, are such as Gautama and his disciples preached long before, and as holy Aryans had taught long before Gautama. Max Müller dwells on the "strange coincidences" which there are "between the language of the Buddha and his disciples and the language of Christ and his apostles. Even," he proceeds, "some of the Buddhist legends and parables sound as if taken from the New Testament, though we know that many of them existed before the Christian era," which is Prof. Müller's quaintly cautious way of saying that the New Testament stories read as if derived from those earlier legends. There is not one of the teachings regarded as most characteristic of Christianity which is not more ancient than Christianity by many hundreds of years, albeit to the Jewish people those teachings were new, as they were also to those Western Gentiles whom the early apostles of Christianity chiefly taught. We cannot explain this by suggesting simply that Jesus Christ was an Essene, though it seems tolerably clear that he had been trained by teachers belonging to that sect; or by suggesting, further, that the Essenes had received their doctrines from Buddhist teachers, though there is strong evidence that they had. There was more in the teaching of Jesus, as there was more in the teaching of Paul, than either had derived directly from the earlier leaders of the Essenes; and in the doctrines of the Essenes there were details which had not been derived from Buddhist missionaries, either directly or indirectly—details which belonged to the Semitic character, and without which no doctrines of purely Aryan origin could ever have found favour among the Jews. Moreover, moral teachings must ever be expected to grow purer and better as the human race advances, insomuch that we can never hope to account for the full value of the best teachings of one age by referring them to the departed teachers of a less advanced one.

Such being the facts to which I have adverted with greater or less fulness in these pages during the last twelve months, I am asked what I myself believe in regard to them, and how I explain the difficulties which to many they appear to suggest. What is really wanted of me, I fancy, is that I should mention what I do *not* believe—that I should say not what I accept, but what I reject. I prefer, however, to answer the question precisely as it is put. In fact, I must decline to do more, on the grounds both of inclination and of duty.

Here, then, are some of the conclusions I accept, and I imagine I shall find few Christian readers of these pages who do not agree with me in accepting the teachings thus suggested.

At any rate we can never go far wrong in adopting inferences which either result directly from ascertained facts, or are at least entirely consistent with them. I believe that early in the first century a teacher of great power, and of singularly earnest character, who was called Jesus, and early known as the Christ or the Anointed, arose among the Jews. I believe that this teacher, a man of pure and blameless life (whatever else, higher yet, he may have been) brought before that people more effectively than any before, the better part of the doctrines—obviously Aryan in origin (whatever Semitic colouring they may have acquired) by which the Essenes had long been distinguished from other sects. I believe that the other sects, and especially the Pharisees, offended both by the doctrines and by the success of this teacher, opposed Jesus and his disciples bitterly at every turn.

Among those who sought most zealously to check the progress of the Essenes, and in particular of the followers of Jesus, was Paul of Tarsus (by birth a Roman citizen), of the tribe of Benjamin, and belonging to the most rigid sect of the Pharisees. Educated in the learning of his day, for which, Strabo tells us, Tarsus was celebrated, Paul went to Jerusalem to study the laws and traditions of his people under Gamaliel, one of the most distinguished of the Rabbis. (His work in tent-making was simply carried out in pursuance of a Jewish custom, not with the intention of making such work his trade.) He was present when still a young man (according to the Pauline author of the Acts of the Apostles, written long after Paul's death) when Stephen was killed. As has often happened in such cases, his earnest and fiery zeal for institutions which he regarded as especially Jewish, was converted into a still more earnest and fiery zeal for the doctrines which he had helped to oppose, so soon as he recognised in the first place their inherent beauty and value, and in the second the integrity and devotion of those who accepted them. He not only became a believer in the "foreign" doctrines, but was moved to teach those doctrines to Gentile races. He had known of Jesus Christ as the chief teacher of the new doctrines, and now taught them himself in the name of Jesus, and as a follower of Him who though dead spoke now through him, and whose resurrection from the dead he taught as an essential part of the new doctrine.

Among the earlier Jewish apostles the views of Paul were strenuously opposed, and by none more zealously than by John, the only other contemporary of Jesus whose actual writings have reached us (unless we accept as genuine the Epistle of Jude, rendered doubtful by the reference to the Gospel of "Enoch, the seventh from Adam," a work with which Enoch had certainly nothing to do), which are quoted probably from Matthew's record. Matthew appears to have left a record in writing of the teachings of Christ. This Gospel appeared in all probability about thirty years after Matthew's death, which we may assume occurred near the year 70. The Gospel according to Matthew has an Ebionite and anti-Pauline tone, which the strongly Pauline Gospel "according to" Luke seems to have been intended to correct. The Gospel (really the second, though placed third) probably appeared about the year 115. In the Gospel "according to" Mark, probably produced about twenty years later, there seems to be an endeavour to reconcile the opposing doctrines. But by this time the Pauline views, on which in fact the establishment of Christianity essentially depended, were generally accepted.

The Gospel according to John cannot have been in existence A.D. 168; for, in the Quartodeciman controversy in that year, the authority of John was cited in direct contradiction to the doctrines which the fourth Gospel urgently maintains. Possibly the appearance of that Gospel very soon afterwards may be attributed to this circumstance.

With regard to the life of Jesus, it is certain that long after he had passed away events were narrated in regard to him such as—either by some strange coincidence or otherwise—were recorded by Josephus as having happened to other persons to his own knowledge, while another series of events, mostly of a much more remarkable nature, were narrated in reference to Jesus Christ, which—either by some still more remarkable coincidence or otherwise—had been related thousands of years before about the sun-god, and afterwards (but still hundreds of years before the time of this great teacher) had been mistakenly attributed to a number of persons who had actually lived, though, as in his case, the accounts only appeared long after such persons had passed away.

So much I believe. Most of this, indeed, is simply a re-statement of facts. Be the significance of these facts what it may, they must be accepted by all who have any real faith (for only the fearful try to blind their eyes to facts). What I do *not* believe—it is not necessary for me to say.

The evidence appears to me decisive that, though the doctrines of Christianity reached the present Christian world from a Semitic source, they are of purely Aryan origin. But, though those doctrines were originally Aryan, they would never have made their way as they did among the races which now accept them had it not been, first, for the specific warmth of colour given them by Jewish teachers, and especially by Jesus and Paul (who were, indeed, the teachers of the Jews): and secondly, for the special circumstances which led to the dispersion of such teachers among non-Jewish races after the Fall of Jerusalem. In the spread of the doctrines of love and justice among races then about to take leading positions in the world, but then (as now) most prone to cruelty and wrong-doing, I recognise the greatest event of which human history bears record, and promise of the worthiest fruit. *But though the fields have long been ripening into harvest the full time for reaping has not yet come: we shall not live to see it, though some even in our day have discerned its fair fields and pleasant homesteads from the Pisgah they sadly and painfully have climbed.*

THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

By Edward Clodd.

PART II.

Chapter II.—The Origin of Life.

THE fascination which the question of the origin of life possesses is not lessened by the slow abrasion of the artificial lines which divide the living from the non-living. Round it, like planet tethered to sun by the invisible force of attraction, the mind of man revolves, unable to disentangle itself and escape into a larger orbit, whence the truer proportions of things may be seen: nor will the undue importance accorded to the living vanish until there is deepened within us that sense of the unbroken interrelation of all things to which science brings her "cloud of witnesses."

It is agreed that there was an "azoic" or lifeless period in the history of the earth—therefore that life had a beginning; and it is with the evidence as to continuity or gap between the azoic and the zoic epochs that the present chapter is concerned.

The azoic stage is evidenced by the primordial temperature of the globe, which, taking the present temperature of the sun as a fair standard of comparison, is computed to have been 14,000 times hotter than boiling water. Under such highly energetic conditions chemical combinations of the vaporous particles were impossible, and, *à fortiori*, vital combinations. But with the slow cooling consequent upon the continuous passage of the earth's molecular energy into space, the combining forces came into more and more active play, forming first the extremely simple and more stable compounds, as water: then the more complex and less stable, as salts; and so on in increasing complexity of material and unlikeness of structure. Obviously an enormous fall in the temperature took place before the superheated mass became cool enough to permit the formation of an outer crust, into the depressions of which, probably at first at the temperature of a dull red heat, the water fell as it was condensed from the vapours which, charged with vast quantities of unabsorbed elements, floated over it.

Thus far, in broad outline, the material foundation for the superstructure of life.

When and *how* did life have its beginning? The first part of the question can be disposed of briefly. We do not know. But we do know that life must be vastly earlier than any record of it.

As to the mode, let us approach the problem by treating of what is common to both the lifeless and the living. Now, in brief, there are no elements in the one which do not occur in the other. The most complex plant and animal, and the lowest living germ, so apparently devoid of structure that it can only by courtesy be called an organism, are made of materials derived, directly or indirectly, from earth and air and water. These materials are oxygen, carbon, hydrogen, nitrogen, with a little sulphur and phosphorus, and still fainter traces of other elements, combined in extreme and elusive complexity. Of the several elements entering into this subtle combination, carbon is probably the element to which the most prominent part is to be assigned. Its compounds are more numerous and important than those of all the other elements taken together, and it possesses the property of uniting in manifold relations both of number and weight. Combining with the foregoing elements, it gives rise to the stuff called protoplasm, a peculiar feature of which is that it is neither solid, liquid, nor gaseous, but semi-fluid, or of sticky consistence. It is from this "physical basis of life" that, by successive modifications, slow in their operations, the teeming variety of living things has been developed. These, as explained already, are made up of myriads of cells, each of which is a life centre, their combination being the sum total of the life of the organism. But the cell itself is an organisation formed from the formless protoplasm, marking the first stage in structure: and therefore the question as to the mode of origin of life narrows itself to the origin, not of complex organisms, nor of cells, but of protoplasm. Given the matter which composes it, and the play of forces and energies of which that matter is the vehicle, wherein lies the difference which gives as one result non-living substance, and as another result living substance? The answer obviously is *that the ingredients being the same, the difference must lie in the mixing.*

We are already familiar in the inorganic world with the existence of the same element in more than one form, but with different characteristics—*e.g.* of carbon, as diamond, graphite, and charcoal; the difference being doubtless due to molecular arrangement. Chemistry also reveals intimate likeness of materials in the compounds known as isomeric, in which the physical and chemical properties vary considerably. It has also manufactured organic compounds, as starch, urea, and alcohol, the production of which was once thought impossible; and if the experiments to produce the living out of the not-living by decoctions of hay and extracts of beef have failed, as we might expect they would, this failure can have no weight against the argument that we cannot think any limit to the possibilities of Nature's subtle transmutations during the vast periods that the earth has been a possible abode of life. And is not the transmutation of the inorganic into the organic ceaselessly going on within the laboratory of the plant under the agency of chlorophyll?

The ultimate cause which, bringing certain lifeless bodies together, gives living matter as the result, is a profound mystery. But, although the living thing affects us much more nearly than lifeless stones and rain, it hides no profounder mystery than they. The "affinities," as in our ignorance we name them, which lock the elements into beautiful crystalline forms, are no whit less wonderful than the motions in matter through which the same elements manifest the phenomena of life. The origin of life is not a more stupendous problem to solve than the origin of water. Both protoplasm and water have properties that do not belong to the individual atoms which compose them, and the greater complexity of the living compound does not constitute a difference in kind, but only in degree. It does not seem, after all, such a far cry from the crystal to the amœba as from the amœba to Plato and Newton. The crystal and the amœba take their place as independent products of physical and chemical change, and cannot do other than obey the law of their development. The crystals of rock-salt, determined by the mutual action of the attractive and repellent poles of their atoms, dispose themselves as cubes; the crystals of snow as hexagons; of sulphur as rhomboids; and the protoplasmic atoms, obeying their polarities and charged with separating energies, dispose themselves "each after his kind." But whilst the crystal grows by accretion at the surface, although even this distinction has its rare exceptions, the cell grows by assimilation or intussusception, *i.e.* by inflowing of nutrition amongst all its parts. Speaking relatively, for nothing is absolutely motionless, the crystal is stable, irresponsive; the cell is plastic, unstable, responsive, adapting itself to the slightest variation; it "stoops to conquer," and so undergoes ceaseless modification by interaction with its ever-changing environment. Life involves delicacy of construction; hence the transient nature of the organic in contrast to the abiding nature of the inorganic. And, strange as it may seem, separation is life; integration is death. For life is due to the sun's radiant energy, which, setting up separative movements, enables the plant to convert, through its mysterious alchemy, the lifeless into the living, thus forming energetic compounds which are used, partly by the thrifty plant for its own vital needs, and largely by the spendthrift animal for its nutrition, to repair waste and maintain functions. Ultimately the energy thus derived from the sun directly by the plant, and indirectly by the animal, passes into space; and "the dust returns to the earth as it was."

Turning to mental phenomena, from its lowest manifestations in the simplest reflex action of the amœba and the sundew when touched, to its highest manifestations in consciousness or self-knowledge, we find the connection between it and the bodily movements a greater *crux* than the connection between the inorganic and the organic. We know that all the thoughts we think, and all the emotions we feel, involve a physical process; that is to say, they are accompanied by certain chemical changes, molecular vibrations in nerve-tissue, involving waste or large expenditure of energy, which is repaired by food. We know that the healthy working of the brain depends upon nourishment, upon abstinence from excess, upon freedom from injury. Starve or stun or stupefy a man, let palsy or paralysis afflict him, and the complex machinery is thrown out of gear. And we know that the larger the proportion of brain to body, and the more numerous and intricate the furrows and creases in the grey matter of the brain, the higher in the life-scale are the mental powers.

But the gulf between consciousness and the movements of the molecules of nerve-matter, measurable as these are, is impassable; we can follow the steps of the mechanical processes of nerve-changes till we reach the threshold across which things are known by us, and beyond that we cannot go. We can neither affirm nor deny; we can only confess ignorance. "If anyone says that consciousness cannot exist except in the relation of cause and effect with certain organic molecules, I must ask how he knows that; and if he says that it can, I must put the same question." * That is the impregnable position of physical science as defined by its greatest living expositor. "Soul is only known to us in a brain, but the special note of soul is that it is capable of existing without a brain, or after death." † That is the unverifiable assumption of dogmatic theology.

INDIAN MYTHS.

By "Stella Occidens."

DAWN.

"THE whole theogony and philosophy of the ancient world," says Max Müller, "centred in the Dawn, the mother of the bright gods, of the Sun in his various aspects of the morn, the day, the spring, herself the brilliant image and visage of immortality." We find this likewise in the mythology of the American Indian races. Michabo, Manabozho, and Hiawatha are names which mean the Great Light, Spirit of Dawn; and Michabo,‡ as he is sometimes called, means the Great White One. He dispels the darkness, and his weapons are thunder and lightning, according to the Dacotahs. He is supposed to have engaged in a desperate struggle with his father, the West Wind, to avenge the death of his mother. When he had succeeded in driving his opponent to the brink of the world, the West Wind cried out, "Hold, my son, you know my power, and that it is impossible to kill me!"

This struggle is supposed to represent the daily encounter between light and darkness that knows no end, both opponents being invincible. The same myth is related with regard to Hiawatha among the Iroquois, Manabozho and Missibizi among the Algonkins and Chippeways. All these names mean Dawn in the different dialects of these races.

A curious likeness to the story of Jonah can be traced in the account of the heroes Manabozho and Hiawatha. Whilst angling for Nahma, the King of Fishes, the monster suddenly darted upward,

> Opened his great jaws, and swallowed
> Both canoe and Hiawatha.
> Down into that darksome cavern
> Plunged the headlong Hiawatha,
> As a log on some black river
> Shoots and plunges down the rapids.

Hiawatha felt his way in the darkness, and pulled his canoe across Nahma's throat. After a great struggle, Hiawatha killed the great fish, and, with the assistance of the seagulls, who pecked an opening in the ribs of the monster, he was soon released from his dark prison.

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* Professor Huxley on "Science and Morals," *Fortnightly Review*, December 1886.

† Principal Tulloch, "Modern Theories in Philosophy and Religion," p. 328.

‡ Brinton, "Myths of the New World," p. 179.

Here we see plainly in the first myth that Hiawatha is the Sun, who engages in a conflict with the West (the sunset region). He follows the West to the brink of the world (twilight), and is apparently devoured by some monster typical of night. Hiawatha does not reappear until the seagulls set him free, and the first light of dawn appears shining through the ribs of Nahma. He is at last released and driven ashore near his lodge in the east, where he reappears in all his glory and is proclaimed victorious over the night.

A myth not unlike the above is told among the Ojibways about the Little Monedo. The latter is swallowed by a great fish, and is cut out again by his sister.*

The Chippeway Indians believe that Michabo resides towards the east, and in the formula of the meda craft, when the winds are invoked to the medicine lodge, the east is summoned in his name. The door opens in that direction, and there, at the edge of the earth, where the sun rises, on the shore of the infinite ocean that surrounds the land, he has his house, and sends his luminaries forth on their daily journey.

According to an Algonkin legend, Michabo was one of four brothers, representing the north, south, east, and west. They are named respectively Wabun, Kabun, Kabibonokka, and Shawano.†

In Longfellow's "Hiawatha," these four winds are introduced. Mudjekeewis, after a great encounter with Mishe-Mowka, the Great Bear of the mountains, overcomes him. The people proclaimed him "Father of the Winds of Heaven":—

> For himself he kept the West Wind,
> Gave the others to his children:
> Unto Wabun gave the East Wind.
>
> . . . .
>
> Young and beautiful was Wabun.
> He it was who brought the morning,
> He it was whose silver arrows
> Chased the dark o'er hill and valley:
> He it was whose cheeks were painted
> With the brightest streaks of crimson,
> And whose voice awoke the village,
> Called the deer and called the hunter.

He felt lonely in the sky, "though the birds sang gaily to him." But, gazing earthward, he perceived a lovely maiden. He wooed her with his smile of sunshine, and, folding her in his robes of crimson, changed her into a star—

> And for ever in the heavens
> They are seen together walking—
> Wabun and the Wabun-Annung,
> Wabun and the Star of Morning.

Captain Argoll, who visited the Potomac in 1610, heard the following from a chief:—"We have five gods in all. Our chief god appears often unto us in the form of a mighty hare" (compare with the Michabo myth); "the other four have no visible shape, but are, indeed, the four winds which keep the four corners of the earth."‡

In the Iroquois traditions the four winds were imprisoned by their Lord in the cave, or "Lodgings of Dawn." This recalls the account given of the Latmian Cave, or "Cave of Night," in which Endymion (the sun) was supposed to sleep at night.* The Thlinket tribes in their traditions and myths "mention two heroes or gods, who existed" at the beginning of time, and procured for mankind all the advantages they now enjoy. The names of these beings or demi-gods were Yeshl or Yehl, the ancestor of the Raven clan, and Khenookh, the ancestor of the Wolf family.†

Yeshl was the creator of all beings and things, and gave the sun, moon, and stars their places. His dwelling-place is nearest where the east wind blows (called by the Thlinkets "Ssannakke"). The Thlinkets imagine this place to be at the source of the River Nass, which enters the sea near the British boundary. The traditions are "that there was a time when the world was not, and man lived in the dark. A Thlinket had a wife and sister, and he loved them so much that he would not let them work. He let his wife sit the whole long day in the cabin, or outside upon a little hill. She always had eight little birds about her with a bright red colour, and if she spoke with any other Thlinket the birds flew away and informed the husband." He became so jealous, "that every time he went to the woods to build canoes—in which art he was a great master—he placed his wife in a box, locking the same."‡

Probably the husband in this story is the sun, and his wife the dawn. He leaves home in the morning, and in the bright light of the sun the dawn disappears; or, according to the Thlinket myth, remains in her cabin at rest. At evening the gorgeous rays of sunset are seen reaching across the sky towards the sun, and these are the eight birds, or messengers, who are bidding the husband, or sun, to hasten home.

The Stakkin Thlinket tells a different story. At one time the sun, moon, and stars were concealed in three separate boxes, by a rich and powerful chief, who guarded his treasures so well that nobody could touch them. Yeshl heard of this, and determined to get them. By a series of devices he obtained the boxes which contained the moon and the stars, and set the latter in the sky. He could not obtain the sun so easily, but, transforming himself into a raven, he flew away to the sky. On the way he heard human voices, but could not see the people, because there was no light on earth. He asked the people to tell him where to place the light, but they said:—"You will only cheat us—you are not Yeshl, who alone can give us light." In order to convince the doubters, Yeshl raised the lid of the box, and at once the sun shone from the heavens in all its splendour.§

Here we see that Yeshl is the dawn, who releases the sun from night; the box represents his imprisonment in the darkness.

Among the Iroquois traditions an account is given by Father Brebeuf, a Jesuit missionary, who resided among the Hurons in 1626, of Ioskeha and Tawiscara—meaning the White One and Dark One, in the Oneida dialect. The brothers quarrel, and the White One, or Ioskeha, conquering his brother, returned to his grandmother, and "established his lodge in the far east, on the borders of the great ocean, whence the sun comes." In time he became the father of mankind, and guardian of the Iroquois.‖

In the Algonkin legends of New England the account of Glooskap closely resembles the above. Glooskap engages in a terrible conflict with his twin-brother Malsumis or Wolf. "He sought him in the deep dark forest and smote him, so

* A tradition exists among the inhabitants of Melanesia, according to which their god Qat tries to get Night for the people, who had tired of perpetual day. He sent fowls to bring the Dawn, after the departure of Night should make it necessary. Next day the Sun crawled away west, and Night came creeping up from the sea. "This is Night," said Qat. "Sit down, and, when you feel something in your eyes, lie down and keep quiet." So they went to sleep. When night had lasted long enough, Qat took a piece of red obsidian, and *cut the darkness*, and the Dawn came out (Prof. Fiske, "Custom and Myth," p. 56). So that the idea of cutting darkness is not peculiar to the Indian mythology.

† Brinton, "Myths of the New World," p. 161. ‡ *Ibid.*

* "Chips from a German Workshop." Max Müller. Vol. II., p. 85.

† "Report of the Population, Industries, and Resources of Alaska," p. 166. By Ivan Petroff. Published at Washington, 1884.

‡ *Ibid.* p. 172.

§ "Reports of Alaska," p. 173. 1884.

‖ Brinton, "Myths of the New World," p. 184.

that he fell down dead."* This is again the victory of day over night.

According to a Passamaquoddy myth, "Glooskap was born in the land of the Wabanaki, which is nearest to the sunrise," where he now dwells. Another story relates that he came over the sea in a great stone canoe, and that the canoe was an island of granite covered with trees. "When the great man, of all men and beasts chief ruler, who had come down from this ark, he went among the Wabanaki." The Indian-English of the above is rather obscurely expressed in the following words: "Gloosecap hat left from ark, come crosse even wiht wabnocelel."†

COAL.

By W. MATTIEU WILLIAMS.

SUPPOSING all the difficulties of sinking described in my preceding papers have been overcome and the seam of coal is reached, the work of sinking is not yet quite finished. The shaft has to be continued downwards through the seam itself, and a few yards below that. This latter extension is to obtain a "sumpf," or "sump," *i.e.*, a well or tank for receiving the water which makes its way through the sides of the shaft, and will afterwards flow from the workings. Until the works are fairly opened, it is usual to draw the water from this by means of a large iron bucket with a hole in the bottom, which hole is plugged by a valve that lifts when the bucket is immersed in the water and closes the hole by its own weight, and the pressure of water above when the bucket rises above the level of the water in the sumpf.

The contrivance for emptying this large bucket when it is drawn to the surface is simple and ingenious. Instead of tilting it over (it is commonly 5 or 6 feet deep and a yard across), the plug valve has an iron pin attached to its lower part, and projecting like a short tail below the bottom of the bucket. The bucket is drawn up and raised a little above the surface of the ground, then a wide wooden trough is slid under it, and the bucket is lowered so that the pin strikes the bottom of the trough, thereby lifting the valve and allowing the water to flow from the bucket into the trough, which conveys it to the waste-water channel. When the roads are made and the pit is in full work a pumping-engine is erected for raising the water, a work which in some cases is very costly.

As already explained, the pit is usually sunk at the lowest part of the seam included in the "royalty" or area to be worked from it, but for reasons that will be readily understood, the working of the coal is not commenced here. In the first place, if the coal were removed from immediately around the shaft the ground would give way, and the shaft itself become a ruin. Besides this the roads required to reach the distant parts of the coal, and to bring it from them to the pit would be liable to extinction by burial. Therefore, the usual mode of proceeding is to begin at the outer or furthermost boundary of the royalty, and work backwards towards the shaft.

In order to reach this outermost portion drifts must be cut to serve as roads for bringing the coal to the shafts, and as channels for the water and ventilation. These are kept sufficiently narrow in the immediate vicinity of the shaft to leave a substantial mass of coal around to serve as a "shaft pillar."

In some exceptional cases (as when an extension of the royalty has been obtained after sinking the shaft) it is desirable to work some of the coal on the deep side of its incline from the shaft. The shaft itself is then sunk below the extreme depth of the coal to be won, and a cross cut made from it, entering the seam at a right angle or thereabouts, so as to effect its drainage. Then the roads to this portion of the pit descend from the shaft, and the coal has to be drawn up them by engine power.

I need scarcely add that the roads of a coal mine are very narrow-gauge railways. They are, in fact, the parents of all railways, this form of iron road having been first used in coal pits, and used there long before they came into practical operation above ground. The iron rails were preceded by wooden rails. The main road of a colliery is called a "mother gate" by old colliers. This word "gate" is used underground according to its ancient Scandinavian signification. *Gata* is the old Norsk or Icelandic for a way or road. *Gat* in modern Norsk and Danish means an inlet or opening. Our colliers in this, as in many other instances, still speak the tongue of Thor, the hammer-bearing god of the primitive miners; have deviated even less than the modern Scandinavians themselves. A gate in subterranean English is not the thing which bars the way, but is the way itself. Similarly the Northern expression "gang your ain gate" means go your own way, not your own *gait*, as commonly supposed.

In driving a gate or road, whether horizontal or more or less inclined, the same difficulty is encountered as in sinking a single shaft. The air gradually becomes worse and worse as the driving proceeds, until at last special contrivances for ventilation become necessary. Either the drift must be divided by a contrivance similar to the brattice of a shaft, or two parallel ways must be driven. The latter is usual, a rib of 6 to 10 yards thickness being left between them. The lower of these serves as the drain or "water gate," the upper is the main road for men and waggons or the "way gate." The side roads from the workings and the way-gate are called "bord-gates."

Where the seam is thick enough these drifts are made between the *thill* or floor (Icelandic again, *thilja*) of the coal and its roof. If the seam is above 6 or 8 feet thick, some of the coal may be left above to form the roof. If, on the other hand, the seam is too thin, the rock above the coal or the floor below is cut away to give sufficient height. The width of such ways is economised as much as possible, as every increase of width increases the dangers of falling roof and "creeping."

This creeping is very curious and instructive. I recommend it especially to the attention of those mathematicians who have gone a very long way from home in order to determine the rigidity or viscosity of the earth's crust, and whose very recondite calculations have so curiously contradicted each other. As Sir William Dawson told us at the last meeting of the British Association, "Hopkins, Mallet, Sir William Thomson, and Professor G. H. Darwin maintain the solidity and rigidity of the earth on astronomical grounds, but different conclusions have been reached by Hennesey, Delaunay, and Airy." Sir W. Thomson especially contends that a great amount of rigidity is indicated by the gravitation of the equatorial protuberance of the earth upon the moon, and the moon upon the equatorial protuberance.

A study of the phenomena of creeping would, I think, supply more reliable results as regards the viscosity of the outer crust of the earth, and show that its rigidity is overcome by a pressure which, cosmically regarded, is very small indeed.

This creeping is a gradual rising of the apparently solid rock floor after the coal is removed from a considerable area.

* Leland, "Algonquin Myths of New England," p. 17.

† *Ibid* p. 29.

Not only does the roof crush down, but the floor bends upwards, owing to the transmission of the pressure of the superincumbent rocks in all directions—that transmission of pressure which constitutes the essential characteristic of fluids. This occurs more or less everywhere, and in old abandoned deep workings the roof and the floor ultimately meet, unless the air or water confined between them is unable to escape. Great permanent subterranean cavities at considerable depths are, I maintain, impossible. As will be seen presently, when I come to the methods of working out the coal, this impossibility has caused us to leave behind hundreds of millions of tons of good coal in our old mines, to be hopelessly buried beyond human reach.

Five to ten feet is the ordinary width of main roads or way-gates. Even this moderate width requires artificial support by means of poles or logs of oak or larch, commonly grown for the purpose in mining districts. These are cut to lengths respectively corresponding to the height and width of the road, two to height for each one for width. They vary from four to eight or ten inches in thickness. The two that are as long as the height are placed upright against the walls opposite to each other; the one matching the width of the road is laid across these as a cap or head-piece. This is continued at intervals of three or four feet in ordinary rock, but when the roof is friable, *i.e.*, liable to crack off in scales as the down-bending proceeds, it is further protected by planks laid from one cap-piece to the other. The expense of this timbering is a serious item in ordinary colliery operations.

In some cases the main roads are arched with brick or stone, like railway tunnels, and even built with an invert arch below to prevent the rising of the floor.

If the creeping or yielding to pressure were such as occurs when homogeneous material, such as metal, is thus forced to yield, no serious mischief would result: a mere bulging might be temporarily remedied by renewed excavation, but the structure of coal and the other rocks of the coal measures being either laminated or stratified, the bending produces superficial disintegration or chipping off in flakes, which too often are of sufficient magnitude to maim, and even crush to death, the man who is working below.

Outsiders hear of the wholesale catastrophes where by explosion of firedamp, or by the wrecking of a shaft, or by the breaking into water accumulated in old neighbouring workings, &c., many men are killed at once: but the far more serious danger to the coal-miner than any or all of these, that of falling roof, is rarely heard of beyond the immediate neighbourhood of the pits. The reason is simply that killing and wounding from this latter cause happens to only one man at the time. But the sum total of these isolated cases, as shown by general statistics, tells a different tale from that of occasional newspaper reports.

In 1883 the loss of life from explosions in coal mines amounted to 134; deaths in shafts, 97; at surface, 108; miscellaneous underground, 246; falls of roof and coal, 469—total, 1,054. Thus in this year falls of roof and coal killed three and a half times as many as explosions. In certain years, when one or two great explosions have occurred, the numbers killed by explosions reach or exceed those killed by falling roof, but generally speaking the fatalities from falling roofs amount to about double the number due to explosions. The numbers wounded, in many cases permanently crippled, by falling roofs is far greater than those killed, as may be readily supposed. Of these we hear little or nothing. It is not in the main roads, but in the side workings or "bord gates" where most of these sad accidents occur. Usually an explosion kills its victims with little or no suffering, the carbonic acid and carbonic oxide instantly resulting from the explosion are anæsthetic in their action, and produce nearly painless suffocation. The crushing accidents are of a peculiarly painful character.

EVOLUTION OF LANGUAGE.

By Ada S. Ballin.

VI.—ROOTS AND THEIR DEVELOPMENT.

ACCUSTOMED as we are to the use of language in its present highly developed state, with all its complications, it becomes somewhat difficult for us to conceive a kind of language constructed of roots—words such as I described in my last; but such a conception is aided by observing how different languages run, as it were, on diverging lines, so that it may be possible, beginning, metaphorically speaking, at the most divergent points, to trace them up to the point of juncture. "Long before the age of Aryan separation the several relations in which a word might stand in a sentence had been clearly evolved, and certain terminations had been adopted and set apart to denote these relations. The creative epoch had passed, and the cases and numbers of the noun had entered on their period of decay. But with the verb it was quite otherwise. Here we can ascend to a time when, as yet, the Aryan verb did not exist—when, in fact, the primitive Aryan conception of a sentence was the same as that of the modern Dayak. Most verbs presuppose a noun, that is to say, their stems are identical with those of nouns."* For example, the Sanscrit *bharâvi-mi*, Greek *tithé-mi*, originally meant "bearing of me." "placing of me."

While the Aryan verb can thus be traced to a nominal form, the Semitic verb was originally, and still remains, a noun, whatever tenses and moods it has gained being of comparatively late origin, and expressing not time but relation, whereas the Aryan verb from the first moment of its existence expressed time. In Hebrew, for example, which may be taken as a type of Semitic tongues, the root, pure and simple, is used to denote the third person singular of the perfect, and the other persons are obtained by attaching affixes. The two so-called tenses, perfect and imperfect, are used interchangeably to express either past, present, or future. Thus Hebrew is a specimen of language composed of nouns. To take an opposite example, in Algonquin everything tends to verbal expression; adverbs and prepositions are regularly conjugated, and nouns are to a great extent verbal forms—for example, *house* is "where they live." The tendency of this language is to very long words, the longest in Elliott's Massachusetts Bible containing thirty-one letters and eleven syllables. It is *wut-appesittuqussun-nooweht-unk-quoh*, literally, "he came to a state of rest upon his bended knees, doing reverence to him."—(J. H. Trumbull). The mere contemplation of it is overpowering, and we turn with relief to apparently simpler cases.

The Eastern division of Polynesian languages, which have alphabets containing not more than ten, and often as few as seven, consonants, their syllables being all open, composed of single vowels or of a vowel preceded by a single consonant, are polysyllabic, but have no inflections, expressing neither gender, number, place, mode, nor person. Their words are impartially used without any change, as verb, substantive, adjective, and even preposition. Their grammar is made up of pronouns, indicative participles, prepositions, and the like, and they possess nothing which can properly be called a verb. In this we approach to the Chinese type of language,

* Sayce, "Introd. Sc. of Lang.," vol. ii., p. 150. See what follows.

in which the word which is practically a root may be used indifferently as one and another part of speech. This type it is which, as I have said, approaches most nearly to what we may imagine to have been the primitive form of root-language.

More than two thousand years ago the Indian grammarians had discovered that all the words of their language could be traced back to certain phonetic forms, which they called "elements," and fierce controversy arose as to whether these "elements," or, as we call them, *roots*, were verbal or nominal, whether the noun or the verb was the older part of speech. But, as Sayce observed: "We must be careful not to fall into the mistake of the Indian grammarians and their modern followers, and confound these roots with verbs or any other of the constituents of living speech. The roots of language are like the roots of the tree with its stem and branches; the one implies the other, but all alike spring from the seed, which in language is the undeveloped sentence of primitive man, the aboriginal monad of speech." According to Sayce, roots "are the last result of linguistic analysis, the elements out of which the material of speech is formed, like the elementary substances of the chemist." *

When, however, I am in favour of the theory that the languages of various families may be reduced by analysis to one primitive form, namely, the root-word, I do not wish this to be understood as a defence of the hypothesis of the common origin of all languages; for, as I have said already, the universal similarity of physiological structure, as well as many of the phenomena of external nature, are sufficient to account for any resemblance which may exist between the tongues of widely-diverging races.

In his rambling work on the "Origins of Religions and Language," Canon Cook, supporting the theory of the primeval unity of language, gives a list of two hundred and fifty words, which he maintains are identical in form and meaning in Egyptian, Semitic, Aryan, and other families. The resemblances are certainly in many cases very striking, as the following instances will show; but it will also be observed that the majority of these words are imitative of natural sounds, a fact which Canon Cook seems to have overlooked. Thus in ancient Egyptian *aā* is an ass, and *mau* cat and lion; *chefer* (*ch* like χ), *scarabeus*, our *chafer*; Cymric, *cwyber* and *cwifio*, our *quiver*, *cwyf* meaning motion, stir, representing the sound of a body shooting through the air; Cornish *chagvyan*, to escape; French *esquiver*; Old High German *chevor*, *cheviro* beetle; in Middle High German *kever*; Anglo-Saxon *ceafor*; Egyptian *refref*, a worm, *reptile*, Greek *erpeton*, from *erpo*, to creep; Sanscrit *srp* or *sarp*; Latin *serpo* and *repo*, imitative of sound produced by peculiar motion of snakes. Egyptian *amam*; Sanscrit *yam*; New Zealand *amu*, to eat, swallow, imitative of the sound of the closure of the lips after a mouthful has been taken. Egyptian *ang* or *ank*, to squeeze, embrace; Sanscrit *anhu-s*; Latin *ango*, to throttle, representative of the guttural sound produced by the person who is being throttled. Egyptian *pad* or *pat*, to flee; *pet-pet*, to cause to flee; Sanscrit *pat*, to flee, fall down; *pātao*, a fall or wing; *pattrin*, a bird, imitative of sound. Compare our *patter* of rain or footsteps. Egyptian *as*, swift; Sanscrit *açva*, a horse, indicative of the sound of rapid motion through air. Compare our word *swish*, also Egyptian *s-s*, or *s-m-s*, horse; Hebrew *sus*; African *so*, *samar*, *so-sa*, and *so-si*; *so-musa*, a mare. Egyptian χ*aru*, to wage war; Sanscrit *hāra*, war; *hr*, to seize violently, probably imitative of the rapid breathing of a man or animal when springing on an enemy or prey. Egyptian *purasha* and *parashu*, to hew; Sanscrit *paraçu*, an axe, sound of cutting through wood. Similarly, Egyptian *shad*, to cut; Sanscrit *cid* (representing ancient *kh* sound); Old Dravidian, *cut*; Zend *shenda*. Egyptian *sper*, wish, request; Sanscrit *sprh*, *sparh*, to desire; Latin *spero*; Old Norse *spir*, to ask, imitative of sound in breathing. Compare Latin *spiro*, I breathe; our *to aspire*, literally "to breathe after." In Hebrew the the ideas of wishing or desiring are expressed by several words, originally meaning to breathe—as, for instance, *ava*, and imitative of sounds produced in breathing. Egyptian *kerer*, to burn; Hebrew *charar* (χ), the sound of which word is very suggestive of the roaring sound of flames; Sanscrit *ghar*, to shine; *gharmes*, heat; Zend *gar*. Egyptian *ash*, *ăshbu*, to consume; Hebrew *ēsh*, fire; Sanscrit *ush*, to burn; *ushna*, hot; *ushra*, flash. Egyptian *shu*, sun or, with a different ideograph, light; Rig Veda *çuc*, shine, blaze; *çuki*, shining, flaming; *çush*, *çûshia*, the demon of drought; *çûshma*, flame; *çûshumi*, blazing; Basque *su*, fire, from the hissing sound of flames. Egyptian *ka*, *ga*, bull or ox; *kauī*, cows; Sanscrit and Zend *gō*, and Egyptian *behes*. Coptic *bahsī*, anciently Egyptian *ab*, calf. Compare Greek *bous*, bullock; ox, cow, are probably derived from sounds similar to those made by the animals. The word *mer* in Egyptian is used in three different senses, with different ideographs: it means—1, to die; Sanscrit *mr̄* or *mar*, *maras*, death; 2, to love; 3, the sea; Coptic *meire*, lake, inundation; Cornish *môr*, and Old Turanian *môr*, meaning the Caspian Sea. In the last sense it is imitative of the murmuring sound of waters.

More obscure, however, is the probable origin and relationship of the following words: Egyptian *āka* or *āga*, to consume by heat; Hebrew *ach* (χ), oven; Sanscrit *agni*, fire; Egyptian *bā*, to shine brightly; Sanscrit *bhā*; Egyptian *rukhu*, to burn; Sanscrit *ruc*, Latin *lucere*; Egyptian *dam*, to subdue with violence; Sanscrit *dam*, Latin *domare*, the original meaning of which was probably to bind; Egyptian *kan*, to beat, conquer; Sanscrit *çan* or *kshaṅ*; Egyptian *kuk*, evening; *kak* or *kakiu*, darkness, night; Sanscrit *çâya* for *khâya*, Latin *cæcus*, blind; Accadian *gig* and *kug*, darkness; Finnish *gi*, night; in the Veda used in the sense to cover, *tamas asit tamasâ gûdham* —"darkness was covered with darkness"; Egyptian *man*, *mēn*, to be steady, abide; Hebrew *amēn*, Sanscrit *man*, puto; Zend *upaman*, Latin *manere*. Greek *man*, verily, in truth, like Hebrew *amēn*, also Greek *mēn*; Egyptian *mäch*, measure, weigh, reflect; Sanscrit *māh*, to measure; Egyptian *māt*, truth, justice; Sanscrit, *mā*, measure.

It is not so easy in the latter instances to see the imitative origin which we may conjecture to lie at the root of the similarity in these words, but in inquiries such as the present we must not lose sight of the fact that words or signs (as I have shown when discussing the language of the deaf and dumb) at first distinctly imitative, after they have been adopted into language, and when there is no longer a risk of their being misunderstood, become conventionalised on the principle of economy of effort. And again, we must remember the powerful imagery of primitive minds, which, on the grounds of some resemblance not apparent to our more analytic brains, will transfer a word from one meaning to another; so that, to take a familiar example, the word *drum*, imitative of the sound of sticks or hands beating on parchment, is applied to the *drum* of the ear, the similarity in this case being the tightly stretched membrane, and having no reference to sound. It is necessary to make these observations, as the facts mentioned are persistently ignored by those who deny what I have called the "natural origin" of language, in order to ascribe it to the supernatural.

There can be little doubt that the earliest means by which

* *Loc. cit.*, p. 3.

man sought to express his thought was, if I may so call it, pictorial. The untaught deaf and dumb, whose ideas are mainly of aspects and actions, as I have shown, express these ideas by gestures which are essentially representations, the young child adds to its expressive gestures sounds which are imitative, and which, being understood by the child's relations, become words, surviving until supplanted by words in ordinary usage. The language of the savage is to a great extent made up of gestures, and hence everything would lead us to believe that the primitive man, whose feelings, like our own, were instinctively expressed, would endeavour to represent his ideas, necessarily very crude, by illustrating them, as it were, representing aspects and actions of things by gestures, and sounds by sounds.

My friend Professor Sayce has observed "There was a time in the history of speech when the articulate or semi-articulate sounds uttered by primitive man were made the significant representatives of thought by the gestures with which they were accompanied, and this complex of sound and gesture—a complex in which the sound had no meaning apart from the gesture—was the earliest sentence."*

The Rev. J. L. Wilson, describing the Grebo language, says it has personal pronouns, but they are rarely used, and whether the verb is in the first or second person and so on is shown by gesture.

Fisher states that the Comanches and neighbouring tribes have "a language of signs by which all Indians and traders can understand one another; and they always make these signs when communicating among themselves."† James writes of the Kiawa-Kashaia Indians: "The nations, though constantly associating together and united under the influence of the Bear-Tooth, are yet totally ignorant of each other's language, insomuch that it was no uncommon occurrence to see two individuals of different nations sitting upon the ground and conversing freely by means of the language of signs. In the art of conveying their ideas they were thorough adepts, and their manual display was only interrupted at remote intervals by a smile or by the auxiliary of an articulated word of the language of the Crow Indians, which to a very limited extent passes current among them."‡

Now the manual sign language, used alike by the uneducated deaf mute and by the savage, is a pictorial language imitative of the aspects and motions of objects, and it is therefore easy to believe that in those who could hear and reproduce sounds vocal imitation would rank high as a means of communicating ideas. The human ear and vocal organs, and the mind which uses them, are and always have been much the same all the world over; and that the first words, wherever developed, were imitative words there is little room for doubt. This interesting subject I shall more fully discuss and illustrate in my next article.

* Introd. Sc. of Lang., vol. i., p. 116.

† Trans. Eth. Soc. (1869), i., p. 283.

‡ "Expedition to the Rocky Mountains," iii., p. 52.

A WHIST SUPERSTITION.

BY "FIVE OF CLUBS."

A CORRESPONDENT (G. B.) sends us the following amusing account of an episode at the whist-table, and of the appearance, alive and to some degree kicking, of a very old whist superstition, which we had supposed to be dead:—

"The other night, while playing whist with two very old packs of cards, misdeals were in consequence frequent. One of our adversaries, after a misdeal, offered a bet that some one in the next hand would hold a single card of some suit. My partner took the bet, but, most curiously, no less than four single cards appeared. Later on he offered two to one, after another misdeal, and won again. I had not heard of the superstition before, and, knowing that the appearance of single cards after dealing with one pack could not be affected by a misdeal with another pack, supposed it would arise from the fact that the odds in any deal whatever would be in favour of some player holding a single card. This idea was scouted; so I went into the question afterwards for my own satisfaction. I should be glad to know if my calculations are correct."

Our correspondent proceeds to calculate the chances in the following way:—He supposes a player to have a spade dealt him first, and calculates the chance that as the rest of that player's hand is dealt another spade will not be given him, finding it quite correctly. He then multiplies that chance by 4 for the several suits, which also is correct in principle. And then he multiplies the resulting chance yet again by 4 for the different hands, which is not correct; corresponding to the mistake of multiplying $\frac{1}{6}$, the chance of throwing "ace" with a die at one cast, by 6, to get the chance of throwing "ace" in six casts, getting 1 or certainty, which is certainly wrong.

But the fact is, our correspondent's result, 7 to 4 against a singleton appearing somewhere among the deals, is far from the truth. His method of calculation errs in this, that it deals only with the chance of there being a singleton in the suit from which the first card dealt to a hand may chance to come; whereas a singleton may show, and is, of course, more likely to show, in a suit which is *not* the first dealt to a hand.

The superstition in question is a very old one. It appears in Bohn's "Handbook of Games" in the following monstrous form:—

"The degree in which whist is arbitrarily affected by the cards may be gathered from the following fact (!):—After a misdeal, on dealing again with the same pack, one of the players will, *nine times out of ten* [the italics are very much ours], hold at most but one card of one of the four suits. How this comes to pass is a problem that remains to be solved: whether the fact be so or not is of very simple proof."

This, of course, outrages sense. Apart from the inherent absurdity of the superstition, we have the absurd statement that the fact can be readily tested. Now misdeals do not occur so often, nor have the results of deals *after* a misdeal been so commonly or so carefully noted that the supposed law can be readily or simply proved from any evidence collected in the past. Imagine a whist party or club undertaking to test the matter, wilful misdeals would of course not count, and what a set of duffers a whist party or club must be which could in any reasonable time provide the hundreds, nay the thousands, of real misdeals which would be necessary to submit the supposed law to adequate experimental test!

But the real chance of a singleton appearing in one or other of the hands, or in more than one, at any deal, is so much larger than most persons suppose that the birth and growth of a superstition of the kind can be readily understood, so many having no idea whatever in these as yet unscientific days of considering causation. Doubtless our correspondent's correct reasoning on this point was scouted by the holders of the fancy he rejected. Yet probably they were not weakminded fancies, which, for persons who considered causation would be to all intents and purposes idiotic, are merely the results of a kind of lazy thoughtlessness in those to whom the idea of causation is unfamiliar.

In reality, the odds at any deal are largely in favour of a singleton appearing in *some hand or other*. Even the chance of a singleton appearing in a *hand taken at random* is much larger than many suppose—no less, in fact, than 4–13 (that is, a player may expect 4 singletons in 13 hands). We leave the proof of this till next month, when we will give it as an exercise for the reader (the *data* will be found at page 196 of our "How to Play Whist").

MAP I.—THE NORTH POLAR REGIONS, ON THE EQUIDISTANT PROJECTION: Being the First Map of the One-Scale Atlas.

ONE-SCALE ATLAS.

NORTH POLAR MAP.

MAP NO. I.—THE REGIONS AROUND THE NORTH POLE.

WANT of space prevents us from giving this month, as we had proposed, an account of the method of dividing the earth's surface into twelve exactly equal parts, for this atlas, and mapping each part, with convenient overlaps, on one uniform projection, in such sort that the scale is practically constant throughout. But we give the first map of the series, whose relation to the others can be recognised from the index maps in the November and December numbers of KNOWLEDGE.

THE NATURALIST'S LABORATORY.

CONTRIBUTION V.

THE floors of houses are usually made in this country of deal and other coniferous woods, which ought to be well water-seasoned; that is, the timber, before it is sawn up into planks, should be soaked in water until all decayable and soluble matters are removed; pure lignin is thus left behind, and when thoroughly and gradually dried affords a material which will not warp much upon the variations of temperature, nor emit foul exhalations. But, from the chemical nature of wood in an unprotected condition, it is apt to imbibe noxious gases, to store them, and to give them forth at sundry times, but more especially when the moisture of cleaning and swabbing is followed by an increase of temperature for drying purposes. This pollution goes on very gradually yet surely, and is a recognised fact amongst sanitarians, whose work has been chiefly directed to the construction of hospital wards, which require to be periodically renovated. With regard to ordinary dwelling-houses, Prof. Dr. Jaeger says*:—"My sister, resident in New York, has told me that one of the best-known German physicians in that city once remarked to her that no house ought to be inhabited for more than sixty years, but should then be pulled down, as it is infected by all the diseases of those who have ever dwelt there. He was right. Probably every reader has at some time or other, on entering an old house full of woodwork, been struck by the unwholesome smell. What is, then, to be done? My readers will scarcely reconcile themselves to the radical remedy suggested by the American physician, nor do I consider it necessary. If all plain wood were to be thoroughly oiled or varnished, I believe that old houses would no longer be haunted by such evil spirits."

M. Boulton's process of timber preserving is briefly summarised by J. A. Westwood-Oliver † as follows:—"He aims at removing the watery moisture in the timber present at the time of injecting coal-oil: while he accomplishes this without the resort to the excessive heat usually employed in drying timber, which he thinks cannot be heated beyond 230° F. with safety, as at a temperature much exceeding 250° F. the woody fibre begins to be decomposed, and the pyroligneous acids are distilled from it, warping and brittleness being also caused. His process is based on the difference between the boiling-point of water, 212° F., and the distillation-heat of creosote, which ranges from 350° F. to 750° F. By the old process the timber was placed in a cylinder from which the air and moisture were partially withdrawn by an air pump, and creosote heated to about 120° F. was introduced; the action of the pump was then discontinued, and pressure pumps employed to force the creosote into the wood. M. Boulton introduces the creosote at a heat slightly exceeding 212° F., and continues the action of the air-pump, thus drawing off the watery vapour, while the creosote is not vaporised. By this means wet wood can be introduced into the cylinder. The logs float on the creosote, which is heated as in a still, and the watery vapour passes through a condensing worm. Wood has been exhibited thoroughly good after thirty years' use. Fences and posts erected in 1855 and beech sleepers creosoted in 1856, with nineteen or twenty years' wear, are perfectly sound."

* This passage is quoted from a little volume entitled "Selections from Essays on Health-Culture, and the Sanitary Woollen System," by Dr. Gustav Jaeger, M.D., Stuttgart, p. 120. It has been ably translated and edited by L. Tomalin. The work is published by "Jaeger's Sanitary Woollen System Co., Limited," of 42 and 43 Fore Street, London, E.C., for one shilling. It ought to be carefully read, and should find a place in the library or bookshelf of every householder who values good health adequately.

† *The Illustrated Science Monthly*, London, October 1885, vol. iv., p. 29, *et sequentes*.

But timber prepared after this fashion is not even sparingly used for buildings as yet, so that it behoves the householder to turn his attention to ready expedients, and to convert existing defective floors into sound and sanitary structures. The upper floors of even some of the best mansions are made of very imperfectly matched planks, so that large interspaces permit of the entry of dust and dirt of the worst description, there to fester upon the slightest favourable occasion and pollute the dwelling. "Carefully covered floors, preferably lined with parquet, add to health; the flooring is preserved, it is cleanly, it is artistic. I may here mention an incident which was related to me by Mr. Howard, of the eminent firm of Messrs. Howard & Sons, Berners Street, Oxford Street, London, W. When Messrs. Howard were laying the floors of Westminster Hospital, they were first of all obliged to pull up the flooring in order to match the boards: they thus discovered over each joist little conical mounds of dust—the accumulated filth of many years. I have no doubt but that to these pigmy heaps is to be attributed much of the permanent contamination of fever and other wards where the cause of illness is due to specific germs, which find their way into these collections; and the septic dust thus established is kept under favourable conditions of warmth and moisture every time that the floors are washed and dried." * Although parquet flooring is necessarily expensive at first, it embraces many advantages of the greatest importance to the cleanly maintenance of the laboratory. The benefits to be derived from its adoption may be briefly summarised as follows:—(1) Freedom from accumulations of dust; (2) the ease with which it can be cleansed; (3) when washed with a wet cloth it does not absorb water; (4) it is beautiful and durable. But where the question of outlay interferes with the employment of parqueterie, the floor-boards ought to be accurately matched, or existing interspaces should be carefully caulked, as on the deck of a ship, not necessarily, however, with oakum and pitch, but with such inexpensive materials as are always at hand. Old newspapers boiled down in starch paste, with a small proportion of glue and a little corrosive sublimate, serve admirably. It may be applied in a plastic condition with an ordinary putty-knife; when dry, it does not shrink, but forms a hard, horny-textured substance. The floor thus prepared may be painted, bees-waxed, or covered with preservative material, and if desired, additionally provided with oil-cloth or linoleum. Carpets and rugs, as dust-harbourers, should never be used.

To polish the floor with bees'-wax the following formula may be adopted with success:—"To prepare wax for polishing floors, 12½ pounds of yellow wax, rasped, are stirred into a hot solution of 6 pounds of good pearl-ash in rain-water. Keeping the mixture well stirred while boiling, it is first quiet, but soon commences to froth; and, when the effervescence ceases, heat is stopped, and there are added to the mixture, while stirring, 6 pounds of dry yellow ochre. It may then be poured into tin cans or boxes, and hardens on cooling. When wanted for use, a pound of it is diffused in five pints of boiling hot water, and the mixture, well stirred, is applied while still hot to the floor by means of a paint-brush. It dries in a few hours, after which the floor is to be polished with a large floor-brush, and afterwards wiped

* "On Health in the House." A paper read at the Conference of the Society of Architects' Exhibition, London, March 5, 1885. By J. Ernest Ady. Vide *Building News*, London, March 6, 1885 vol. xlviii., p. 361.

with a coarse woollen cloth." It is said that a coat will last six months.*

Of preservative media, adapted to the floor of the laboratory, the two under-mentioned are worthy of trial:— 1. "Mix together boiled linseed oil and finely powdered coal, to produce a substance of the consistency of paint. Apply a coat of this to the floor." 2. "A mixture is made in a metal pot of 40 parts of chalk, 50 resin, 4 linseed oil, and 1 part of native cuprous oxide. One part of sulphuric acid is cautiously stirred in. A sort of mastic results, which may be applied hot, and when dry forms a varnish hard as stone." †

In spite of every care, however, dust will creep into the laboratory, from our clothing, boots, the wear and tear of furniture and instruments, books, fireplaces, and lamps. But when all the precautions noted above are carefully observed, it will be found that occasional wiping with a rag leaves the room practically clean and comfortable; and the student will then be able to indulge in delicate dissecting with the microscope and elaborate mounting of objects, without any fear of danger from floating dirt, and with a rapidity which would be impossible under any other circumstances.

Under the name of the "Dust Inhaler," a very ingenious contrivance has been devised and patented by a Mr. Newton, whose specification is thus given:—"A horizontal fan suspended and revolved in a hollow cone over a tray of water, creating a partial vacuum in a small cylinder above the fan, from which, and connected to it, an elastic tube of any length, with a revolving hair or other brush at the end of the same, so that the brush loosens the dust, and the current of air entering the partially-exhausted tube carries the dust with it through the fan, and impinges on the surface of the water; the air then passes through perforations free of dust." ‡ The apparatus is useful for sweeping floors, carpets, footpaths, &c.; to dust walls, curtains, and clothing; and, as it proceeds, collects the dust to deposit in the tray of water: hence its value in the laboratory cannot be over estimated.

LABORATORY FURNITURE.

The subject of laboratory furniture has received but a modicum of attention in this country, although our Continental neighbours, and especially the Germans, have made vast strides in this direction. The poor naturalist is not even so fortunate as his chemical brother in this respect, for whilst the latter can procure ready-made furniture suited to his requirements, the former is invariably compelled to make shift with what he can borrow from various quarters—the kitchen, bedroom, and other domestic sources—or is obliged to call in the aid of an architect or carpenter to design and produce articles upon the spur of the moment which are afterwards found to be wanting in many essential details when they come to be tested in the severe school of "mother experience." In this way it often happens that articles of the most heterogeneous assortment find their way into his sanctum, and give it more the character of a lumber-room than a well-regulated workshop; these remarks extended, it is to be deplored, are, with but slight modifications, equally applicable to biological and geological laboratories in even some of our modern universities and colleges. But chairs and tables, cupboards and book-shelves, &c., do not constitute the sum of all that is required for the adequate equipment of the apartment; there are also reagent stands and bottles of suitable shapes and sizes; vats and jars for decayable specimens; boxes and cabinets for minerals, rocks, and dry materials; aquaria for plants and animals; a hot and cold-water supply; and rational wearing apparel for the worker; all of which call for description in this place rather than amongst the instruments that are directly employed by the student to assist him in his researches.

* *The Illustrated Science Monthly*, London, March 1885, vol. iii., p. 95.

† *Ibid.*, August 1885, vol. iii., p. 254.

‡ Patent Office Register, No. 14,050, A.D. 1884.

SOLUTION OF PUZZLES.

PUZZLE XIII. *It is required to divide* ABCD, *fig.* 8, *by straight cuts into four parts, which shall fit in* aFLK (*fig.* 9), *a parallelogram having the angle* a *equal to the angle* A, *and its sides* aF, aK *in a given proportion, by the first of the two methods employed for rectangles in the last number.*

In AB take E (fig. 11), so that AD : AE : : aK : aF. On AB (towards DC) describe the circular arc AFB to contain an

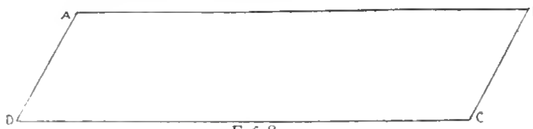


Fig 8

angle AFB equal to the angle ADC. (Complete the circle, for future purpose, by the arc AF'B containing an angle equal to the angle DAB.) Through E draw the chord FEF' parallel to AD; draw FB cutting DC in H; and take FL equal to HB. Complete the parallelogram AKLF. Then I leave it to the student to show by similar triangles AEF, FAB; and by the proportion DA : AE : : aK : aF (fig. 9), that AKLF is in all respects equal to aKLF. It will also be easy for him to see

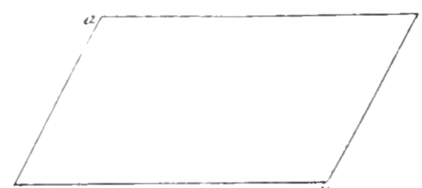


Fig 9

that if KM is drawn parallel to AD, the spaces numbered 1, 2, 3, 4 in ABCD are in all respects equal to the spaces similarly numbered in AKLF.

Thus ABCD is divided as required.

PUZZLE XIV.—*To do the like by the second method employed for rectangles in the last number.*

Part of the construction is shown in fig. 11, AF' being the shorter side of the rectangle required. We complete the parallelogram AKLF as in fig. 12; take BG equal to FL, and

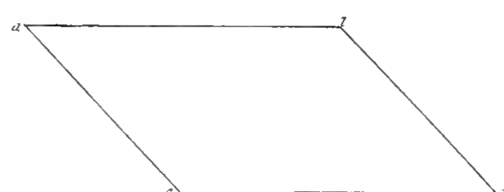


Fig 10

draw the parallels JG, GM, cutting off also the small triangle *ghk* equal to JFG in all respects. Then the parts of ABCD, numbered 1, 2, 3, 4, are in all respects equal to the parts similarly numbered in AKLF.

NOTE. Remarks similar to those made in regard to the division of rectangles apply also to the division of these equi-angled parallelograms—more cuts (or fewer) may be required according to the proportions of the different rectangles. But no difficulty will be found in extending the construction to cases where one or other or both parallelograms have very unequal sides.

PUZZLE XV.—*To divide either of the rectangles* ABCD (fig. 8) *and aklf* (fig. 10) *by straight cuts into three parts, which shall fit so as just to cover the other.*

It will be obvious from a few moments' study of figs. 11 and 12 that the rectangle AKLF in either figure can be

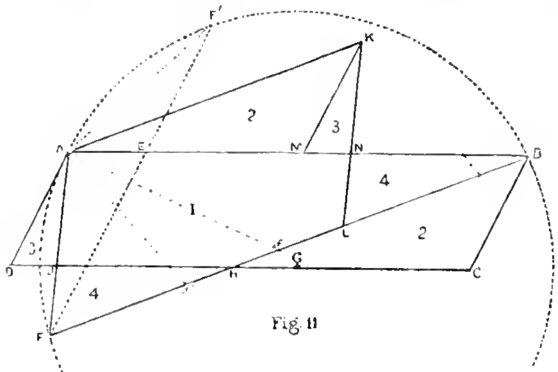


Fig. 11

divided as by lines Af, Af', Kl, Kl', in such sort that, by dividing the corresponding parts of ABCD in like manner (which is done in both figures by light broken lines), the parts of ABCD so obtained will fit on a rectangle having Af or Af', or Kl or Kl' as a side, the other adjacent side being AK. For the pieces forming triangle AFf' may be carried to

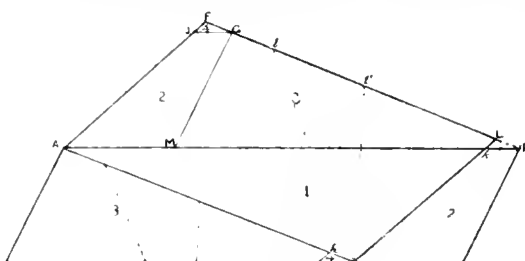


Fig. 12

fit on the side KL, or those forming AFf' may be so carried; or those forming KlL or Kl'L carried over to fit on the side AF.

In different cases the number of cuts required will be different. But we see that for the case referred to in the puzzle, the only extra division line is Af, fig. 11, while the cuts corresponding to AJ, KM need not be made. We draw

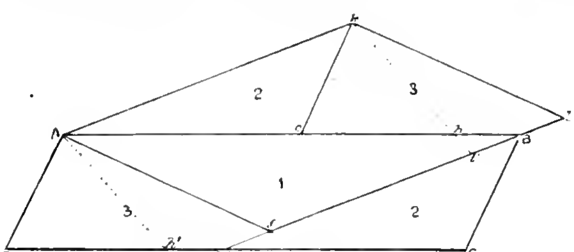


Fig. 13.

simply HB, Af, fig. 13, and fit the pieces numbered 1, 2, 3 in ABCD upon $aklf$, as shown.

For the case corresponding to the side Af', fig. 11, for our rectangle, we get the cutting shown in fig. 13 along khl, kl', corresponding to Ah' and hl' on the parallelogram ABCD.

NOTE.—We only get a division into three parts when the extra dividing line runs as from A to a point in HL, fig. 11, or when, in the case illustrated by fig. 12, KkL cuts BC, and a line is drawn from A to a point in KL between K and BC. In the latter case the parallelogram formed of the pieces will have a side equal to AF, and not (as in the former case) to AK. It will be observed that by such methods any parallelogram can be divided up into parts which shall fit another parallelogram of any shape whatsoever.

PUZZLES XVI., XVII., AND XVIII.

A *MAN has 687 oranges to send off, each of which, in packing, is to be regarded as a 2-inch globe, and there must be no compression. He has three boxes apparently equal; but on measuring their inside capacity he finds that No. 1 has a base* 11 *inches square, and is* $11\frac{9}{10}$ *inches deep; No. 2 has a base of 12 inches by* $11\frac{1}{4}$ *and a depth of* $11\frac{4}{5}$ *inches; and No. 3 has a cubical interior* $11\frac{9}{10}$ *inches each way—length, breadth, and depth. He packed all his oranges in these three boxes. Our three puzzles for this month are :—*

PUZZLE XVI. *How did the man pack 200 oranges in box No. 1?—11 in.×11 in.×*$11\frac{9}{10}$ *in.*

PUZZLE XVII. *How did he pack 231 oranges in box No. 2?—*$11\frac{1}{4}$ *in.×*$11\frac{1}{4}$ *in.×*$11\frac{4}{5}$ *in.*

PUZZLE XVIII. *How did he pack 256 oranges in box No. 3?—*$11\frac{9}{10}$ *in.×*$11\frac{9}{10}$ *in.×*$11\frac{9}{10}$ *in.*

In which of the three boxes was the packing closest?

SPECTRA OF A VARIABLE STAR.—At a recent meeting of the American National Academy of Sciences, Professor O. T. Sherman, of Yale, presented a catalogue of bright lines observed in the divorse changing spectra of Beta Lyræ, the well-known variable star. Sometimes all the bright lines are seen; at other times only part of them or none at all, while at times the lines are all dark. Some of the spectra indicate the existence of magnetism and other metals in the atmosphere, in a free and uncombined state. The observations indicate that a triple division exists in the atmosphere, the outer layer consisting of carbon and hydrocarbons which occasionally descend into a subjacent layer of oxygen, and undergo combustion and ultimately descend into the third layer, where the intense heat again separates the products of the combustion into their chemical elements. This theory completely explains the difficult problem of the cause of variability in the variable stars, since it is obvious that periods of extensive combustion must be attended with bright light which at other times are lacking. The observations were made by using lenses of great dispersive power and diffraction gratings.

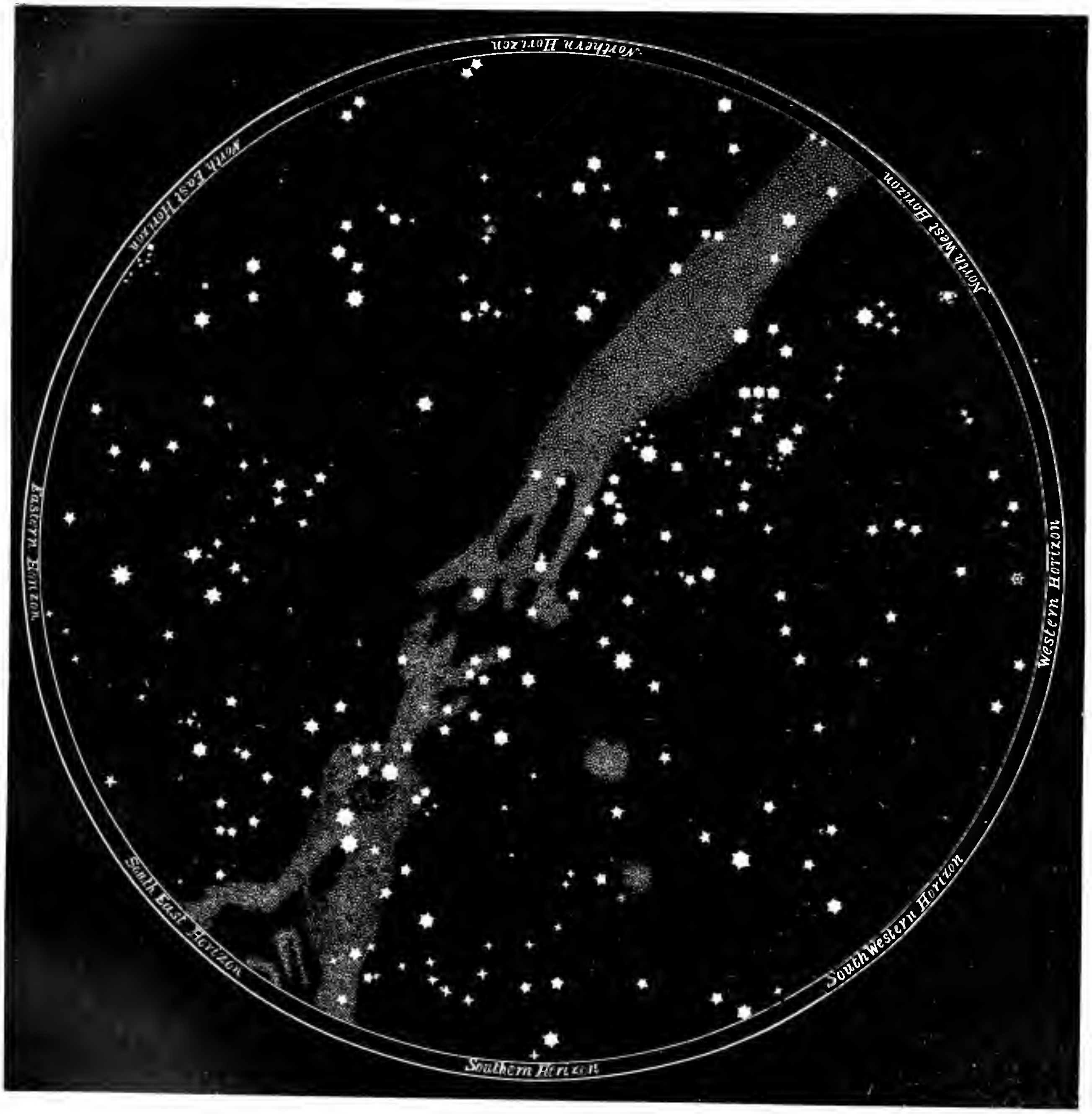
MGR. CAPEL AND A KENTUCKY GIRL.—Mgr. Capel was the subject of a talk the other evening, the spokeswoman of the party being the daughter of our ex-minister to a foreign court and a Catholic. "I don't mean the man," she said. "He is ill-mannered. It was this way: I was talking to him and in some way referred to my youth, and said I had been raised in Kentucky. 'But, madam,' he said, with provoking irrelevancy, and in a tone of supercilious criticism, 'You should not say "raised." "Bred" is better; we say so in England.' 'Do you?' I answered with considerable warmth; 'well, I don't. In Kentucky we breed cattle and horses and mules' [and formerly niggers she might have added] 'and we raise children.' Then I turned my back on him quite as politely as he had begun the dispute and I felt better."—*Washington Post.*

THE SOUTHERN SKIES FOR MARCH.

THE SKIES OF SOUTHERN LATITUDES AND THE SOUTH HALF OF OUR SKIES AT HOME.

TOWARDS the south in England we see, at the hours named under the map, the skies shown in the map's upper half. Along the horizon, due east, the Virgin is rising: in the south-east a few stars of *Corvus* the Crow, and the whole constellation *Crater* the Cup, are seen. Due south is a part of Argo, merely the poop showing above our horizon; on its right the Dog *Canis*; Orion in the south-west: and beyond, towards the west, a part of the River, *Eridanus*; and the head of the Sea Monster, *Cetus*, almost due west.

Travelling southwards, the voyager at the same seasons and hours sees more and more of Argo towards the south. In the manner described last month, the Centaur, the Cross, and the Magellanic Clouds rise above the southern horizon, precisely at the rate corresponding to the traveller's journey southwards over a spherical surface. A study of the map combined with the explanation given last month, will suffice to show precisely how the southern skyscape varies at this season, with the progress of the traveller towards the latitudes for which the map has been constructed. When those latitudes have been reached, the stellar heavens are presented as shown in the map, the centre marking the point overhead, and the circumference the horizon.

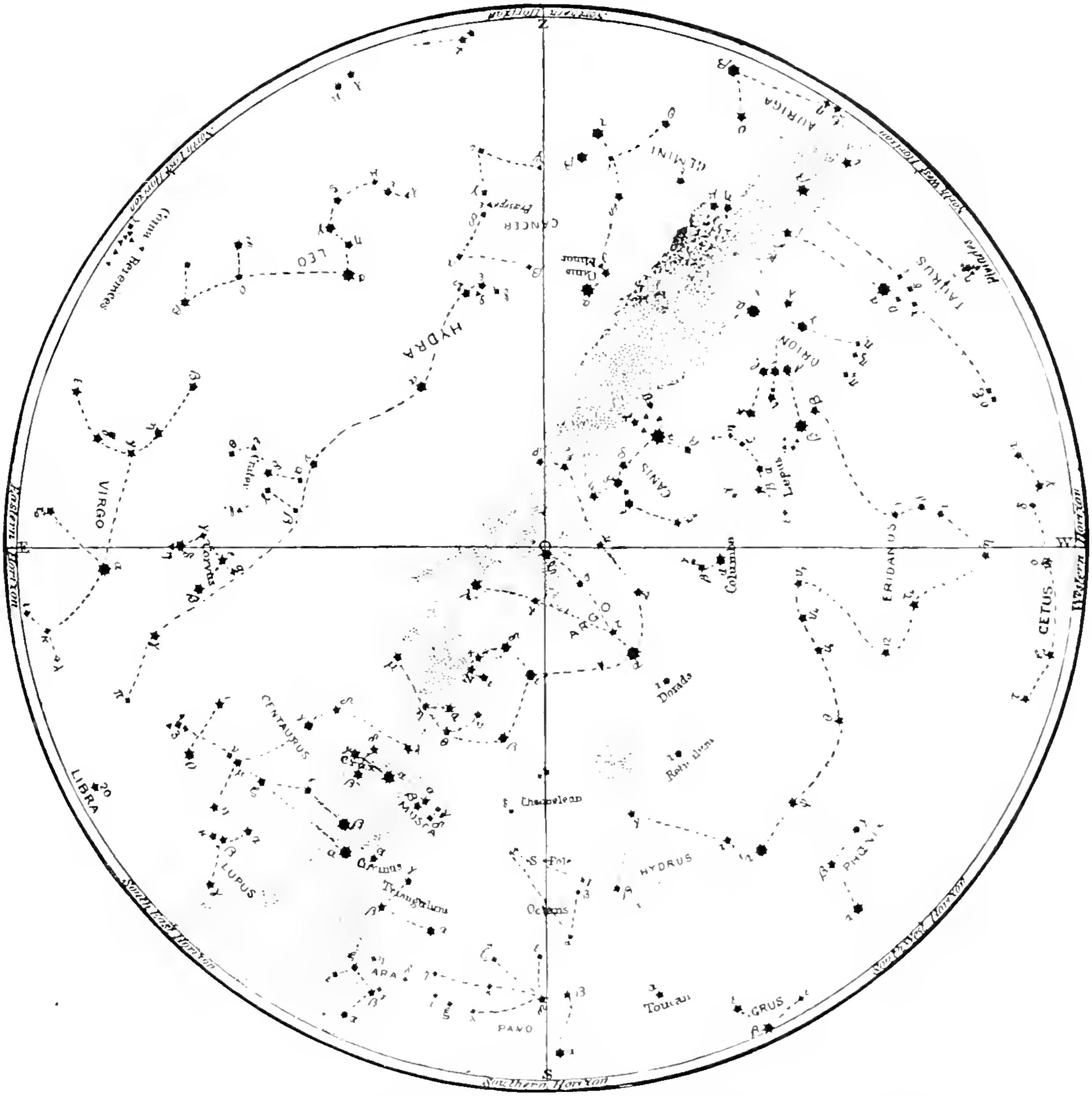


NIGHT SKIES OF THE SOUTHERN HEMISPHERE FOR MARCH.—For Index Map see opposite page.

Due south, below the pole, the Peacock, *Pavo*, pleasantly imagined by Lacaille as a suitable companion for the Indian, an Octant, an Altar, and a Triangle, stands naturally on its head. In the south-east we see the Centaur, offering the Wolf, *Lupus*, on the Altar, *Ara*, all being in extraordinary positions, for *Centaurus* is prone on his human face and his equine chest and forelegs, while the Altar is inverted. The Cross, *Crux*, lies on its side, half-way between the horizon and the point overhead.

On the western side of the south we see the Magellanic Clouds, high up; the Phœnix low down in the south-west, galactic stream is interrupted, and two fan-shaped expansions stretch out towards the dark gap.

Turning to the east, we see the Virgin, *Virgo*, low down; above her, *Corvus*, the Crow, and above that, slightly to the left, the Cup, *Crater*. *Hydra*, the Sea Serpent, of which these two small constellations were once part, extends athwart the mid-east towards the mid-north, near which we see the Sea Serpent's head. In the north-east is the Lion, *Leo*; next him, nearly due north, is the Crab, *Cancer*; then,



NIGHT SKIES OF THE SOUTHERN HEMISPHERE FOR MARCH, SHOWING THE SOUTHERN HALF OF OUR NORTHERN SKIES (UPPER HALF OF THE MAP) AND THE WHOLE OF THE SKIES IN SOUTHERN LATITUDES, AT THE FOLLOWING TIMES:—

At 10 o'clock, March 8.	At $9\frac{1}{4}$ o'clock, March 20.	At $8\frac{1}{2}$ o'clock, March 30.
,, $9\frac{3}{4}$,, March 12.	,, 9 ,, March 23.	,, $8\frac{1}{4}$,, April 3.
,, $9\frac{1}{2}$,, March 16.	,, $8\frac{3}{4}$,, March 26.	,, 8 ,, April 7.

and the River *Eridanus* straggling along towards the west and beyond; besides several small constellations and parts of constellations not very noteworthy.

Overhead is the Ship *Argo*, and the very interesting region of the Milky Way, in the midst of the Ship, where the great west of north, we see *Gemini*, extended horizontally; and, passing along the zodiac, we come to *Taurus*, extending low and long, above the north-west horizon.

Nearly overhead, in the north-west, is *Canis*, the Dog, with the splendid Sirius, shining more brightly, though less beautifully than in our northern skies, where his light is always affected with the colouring due to atmospheric undulations. Next, high in the west, is the small Hare, *Lepus*; and in the very middle of the north-west quadrant of the heavens we see Orion, which alone of all these familiar constellations is easily recognised, seeing that, whereas the Lion, Twins, and Bull, the Dog, the Hare, and the Sea Monster (low down in the west) present forms quite unlike those we know, Orion with his gleaming belt stars and the bright Betelgeux, Rigel, and Bellatrix at once shows himself for what he is—the noblest constellation in the heavens.

ORIGIN OF COMETS AND METEORS.

By Richard A. Proctor.

I OBSERVE that at the last meeting of the Astronomical Society, my friend Mr. Ranyard, remarking on the ejection theory of comets, shows that the wideness of the radiant area of the Andromede meteors can be explained without that theory—with which (I had pointed out) it accords well. I should not wonder if the peculiarity can be explained in another way, or in half a dozen other ways. I have, however, never found in my own experience, or noted in the experience of others, that a new general truth can be reached by nibbling at details in that way.

The theory of ejection was adopted as the only theory by which the chemical, physical, and microscopic structure of meteorites of all orders—from holosiderites to asiderites—can be accounted for. They were certainly once exposed to such conditions as exist only in the interiors of large orbs—suns or planets. And as certainly they have somehow come forth from such interiors. The expulsive force shown by observation to reside in the only sun-like body we can examine, indicates the only way in which such expulsion can conceivably have been effected. Hence I infer (for my own part I feel assured, knowing the weight of evidence) that all orders of meteorites were expelled from some orbs at some time when such orbs were in the sunlike stage. Generalising, I include in this theory all orders of meteors, and find all their most characteristic peculiarities explained, and all orders of meteor systems or comets, finding their several orders thus and thus alone explicable (if we include all suns now and in the past, all planets in all solar systems, in their past sunlike state, among the sources of meteors and comets).

No other general theory seems to me possible. Certainly no other has been advanced. (Schiaparelli's capture theory explains nothing, besides being dynamically impossible.)

This being so, to prove that some tiny little detail might be reconciled with some imagined prior state of things, which might or might not agree with this general theory, seems to me a waste of time, so far as the question of the origin of comets and meteors is concerned.

I find the same fault in nine-tenths of the reasoning employed in the discussion of general theories. The idea seems to prevail that a theory may be established or overthrown by proving some bare possibility about some exceedingly small detail. It is as though one were to show that the movement of a particular piece of iron towards the earth might have been caused by a magnet placed in such and such a position, and thereupon were to say, "Where is your theory of terrestrial gravity *now*?"

Another way, as the cookbooks have it—a method peculiarly affected by some American astronomers I wot of—is to show that one particular part of a theory will not explain a group of facts which belongs to another part of the theory—as, for instance, that the expulsion of matter from the sun cannot explain the closed orbits of the Leonids or the paths of comets nowhere approaching within many millions of miles of the sun.

What has really to be considered in such a case is the bearing of a general theory on the facts, many in number and diverse in aspect, which suggested it, and which it is intended to explain; not whether this or that fact can be separately explained in some other way, or whether one branch of the theory is able to explain the facts relating to another. Why take up matters which can be explained in a hundred ways, when we know that the really determinant facts are those which can only be explained in two or three ways, or perhaps only in one?

A YANKEE AT KING ARTHUR'S COURT.

REPORT OF A DISCOURSE BY MARK TWAIN.*

MR. CLEMENS said that that which he was about to read was part of a still uncompleted book, of which he would give the first chapter by way of explanation, and follow it with selected fragments, "or outline the rest of it in bulk, so to speak; do as the dying cowboy admonished his spiritual adviser to do, 'just leave out the details, and heave in the bottom facts.'"

Mr. Clemens' story is the autobiography of Sir Robert Smith, of Camelot, one of King Arthur's knights, formerly a manufacturer of Hartford, Conn. Robert Smith says of himself:

"I am a Yankee of the Yankees, a practical man, nearly barren of sentiment or poetry—in other words, my father was a blacksmith, my uncle was a horse doctor, and I was both. Then I went over to the great arms factory and learned my real trade—learned to make everything, guns, revolvers, cannon, boilers, engines, electric machines, anything, in short, that anybody wanted anywhere in the world. . . . I became a head boss and had a thousand men under me. Well, a man like that is full of fight—that goes without saying. With a thousand rough men under one, one has plenty of that sort of amusement.

"At last I met my match; I got my dose. It was during a misunderstanding conducted with iron crowbars with a fellow we used to call Hercules. He laid me out with a crusher alongside the head that made every joint of my skull lap over on its neighbour, and then the world went out in darkness and I felt nothing more, knew nothing more for a while, and when I came to again I was standing under an oak tree and the factory was gone.

"Standing under an oak tree on the grass with a beautiful broad country, a landscape spread out before me—all to myself. No, not quite, not entirely to myself. There was a fellow on a horse looking at me—a fellow fresh out of a picture-book. He was in old-time armour from his head to his heel. He had a helmet on like a cheese-box with slits in it, and he carried a shield and sword and a prodigious spear. And his horse had armour on, too, and gorgeous silken trappings, red and green, that hung around him like a bedgown to the ground. And this apparition said to me:

"'Fair sir! Will you joust?'

* Delivered at the last meeting of the Military Service Institution, Governor's Island, General J. B. Fry in the chair; Generals W. T. Sherman and Schofield on the platform.

"Said I, 'Will I which?'

"'Will you joust? Will you break a lance for land or lady?'

"Said I, 'What are you giving me? You go along back to your circus, or I'll report you.'

"Now what does this fellow do but fall back a couple of hundred yards, and then come tilting at me as hard as he could drive, his cheese-box down close and his long spear pointed straight at me. I saw he meant business, so I was up the tree when he arrived. Well, he allowed I was his property; the captive of his spear. There was argument on his side and the bulk of the advantage, so I judged it best to humour him, and we fixed up an agreement. I was to go along with him, and he wasn't to hurt me. So I came down, and we started away, I walking by the side of his horse; and we marched comfortably along through the glades and over brooks that I could not remember to have seen before. It puzzled me ever so much, and yet we didn't come to any circus, or any sign of a circus, so I gave up the idea of a circus, and concluded he was from an asylum. But we never came to any asylum, so I was up a stump, as you may say."

And so the two wander on together, and amid scenes of human life that afford the author many opportunities for quaint philosophic contrasts and dry humour, until they came to Camelot, to the Court of King Arthur. Fanciful and curious are the reflections of the transposed Yankee about that place—which he at first thinks must be the asylum—in its country of soft, reposeful summer landscape, as lovely as a dream and lonesome as Sunday, where the air was full of the smell of flowers and the buzzing of insects and the twittering of birds, and there were no people, or waggons, or life, or anything going on.

Very vividly he portrays the scene at Camelot, where King Arthur, with his knights, sits at a round table as big as a circus ring, and three hundred dogs fight for bones around them; while the musicians are in one gallery high aloft, and the ladies in another. But before he gets in there he seeks information from a plain-looking man in the outer court, saying to him: "'Now, my friend, do me a kindness. Tell me, do you belong to the asylum, or are you just here on a visit, or something like that?' And he looked me over stupidly, and said: 'Marry! Fair sir——' 'Oh!' I said, 'that will do. I guess you are a patient.' To another he said: 'Now, my friend, if I could see the head-keeper just a minute—only just a minute.' He said: 'Prithee do not let me.' 'Let you what?' 'Do not hinder me, if the word please thee better.' And he was an under-cook, and had no time to talk, though he would like to another time, for it would just comfort his very liver to know where I got my clothes.'

Then another—a lad—came to him, saying that he was a page. "'Oh! go along,' I said; 'you ain't more than a paragraph.'" The page happened to mention that he was born in the beginning of the year 513.

"It made the cold chills creep over me. I stopped and said, a little faintly, 'Now, maybe I didn't hear you just right. Would you say that again, and say it slow? What year did you say it was?'—'The year 513.'

"'And, according to your notions—according to your lights and superstitions—what year is it now?'—'Why,' he said, 'the year 528, the 19th of June.' Well, I felt a mournful sinking of the heart, and muttered, 'I shall never see my friends again—never see my friends any more; they won't be born for as much as a thousand years.'"

The speaker had often been interrupted by laughter, but at the originality and fun of that conceit his auditors laughed until they cried, and kept on laughing with renewed outbursts over and over again. How the 'cute Yankee determined to get at the bottom facts about the year by watching for a total eclipse of the sun, that he remembered the almanack of 1884 had spoken of as having occurred in 528, will have to be learned from the book when it appears.

"I made up my mind to two things. If it was still the nineteenth century, and I was amongst lunatics and couldn't get away, I would boss that asylum or know the reason why, and if, on the other hand, it was really the sixth century, all right. I didn't want any better thing; I'd boss the whole country inside of three months, for I judged I'd have the start on the best educated man in the kingdom by 1,300 years. . . . . But I'm not a man to waste time, so I said to the boy: 'Clarence, if your name should happen to be Clarence, what's the name of that duck, that galoot, who brought me here?'"

The galoot turned out to be Sir Kay, the seneschal. In the natural course of the story came the charming description of the interior of King Arthur's castle, leading up to a royally funny account of the competitive lying of the gallant knights about their feats at arms. The transposed Smith looked upon the knights as a sort of "white Indians," admired their bigness and their simplicity, and eventually concluded:

"There didn't seem to be brains enough in the entire nursery to bait a fishhook, but you didn't mind that after a little while, for you saw that brains were not needed in a society like that, and would have marred its symmetry and spoiled it."

Everybody goes to sleep when Merlin reels off that same old story about Excalibur. Guinevere makes eyes at Launcelot in a way that would have got him shot in Arkansas. King Arthur orders the Yankee to go to some unknown place not down in any map, capture a castle, kill the colossal, saucer-eyed ogre who owned it, and release sixty royal princesses. Of course he went, but he reflected.

"Well, of all the d——d contracts, this is boss! I offered to sublet it to Sir Launcelot, to let him have it ninety days, with no margin; but 'No,' he had got a better thing. He was going for a menagerie of one-eyed giants and a college of princesses."

It occurs to him finally, after wondering if a compromise with the ogre wouldn't work, simply to go back and tell the king with artistic circumstantiality of detail, that he was killed by the ogre. He does so, and, of course, the king and his knights, who are used to swallowing each other's huge lies, readily take in his, and a brilliant career opens before him as the boss liar of the court.

He took a contract from King Arthur to kill off at one of the great tournaments fifteen kings and many acres of hostile armoured knights. When, lance in rest, they charged by squadrons upon him, he, behind the protection of a barbed wire fence charged with electricity, mowed them down with Gatling guns that he had made for the occasion. He found that the "education of the nineteenth century is plenty good enough capital to go into business in the sixth century with," and the next year he was running the kingdom all by himself on a moderate royalty of 40 per cent.

He spoiled the ogre business; cleared out the fuss and flummery of romance, and put King Arthur's kingdom on a strictly business basis. Inside of three and a half years the improvement was complete. Cast-iron clothes had gone out of fashion. Sir Launcelot was running a kind of Louisiana lottery. The search for the holy grail had been given up in favour of a hunt for the north-west passage. King Arthur's 140 illustrious knights had turned themselves into a stock-board, and a seat at the round table was worth 30,000 dols.

Gossip.

By RICHARD A. PROCTOR.

I SHALL have remarks to make later about a sundial for mean time and a tellurium described and pictured for me by two correspondents and about a question relating to Euclid, Book I., 32, and Axiom 12, by another.

* * *

I GIVE this month, as illustrating Americanisms not only of words but of manner, an account of a humorous lecture delivered by Mark Twain a few weeks ago in New York. The "Notes" will be continued next month. There is in any case no occasion to hurry with the alphabetical treatment of Americanisms, seeing that modes of expression supply quite as good illustrations of the way in which our cousins across the Atlantic speak English as mere words. The reader of Mr. Clemens's amusing address will find several illustrations of American peculiarities, and of modes of speaking which, if not absolutely peculiar to America, are more commonly to be noticed in the States than in the old country.

* * *

I AM reminded for a moment of the peevishly ignorant criticism in the *Saturday Review* some time back. A new weekly, speaking of my remarks thereanent, says that I interrupted my notes to "go for" that critic—as Americans say. I would invite attention to the fact that most of what I said related directly to Americanisms. My critic's ignorance of the subject gave me occasion to explain correctly a number of words which he had blundered over. Except in not being alphabetically arranged, the words "Gum," "Use," "Peart," "Horse Fiddle," and a number of others, belonged as truly to my "Notes on Americanisms" as any in former articles. I was interested myself to notice how much more occasion there was for explanation of Americanisms than I had supposed; since here was one who at least pretended to know something of the subject falling into mistake after mistake about the simplest, and, I had supposed, the best known, American usages.

* * *

FOR the rest, the *Saturday Review* critique illustrated well what I formerly said in these pages in comparing anonymous detraction to dynamite. For though the weakness of the style, and the ignorance in regard to details, sufficed to assure me the article was not written by anyone worth considering, certain coincidences led me to the mistaken idea that points had been suggested by one of very different quality. I suffer the annoyance of having made this mistake, and of having so caused annoyance to others whom I greatly esteem. All which would have been prevented if the *Saturday Review* criticisms were signed, or if at least the columns of that paper were open to an occasional line of remonstrance or explanation.

* * *

I LEARN, however, with satisfaction and some amusement, that the proprietors of the paper have recently had a lesson in this respect.

* * *

WHAT a strange system it is, anyway, by which, in the case of all works really the product of long and careful labour, criticism is often entrusted to writers who have given scarcely any time and attention to the subject. A man shall give twenty years to some special study, and present the result of his work in book form: then does John Noakes or Thomas Styles, sitting down quickly, proclaim that——"While 'we' find a good deal that is interesting in this work, we must point out that the conclusions of the author are not such as will commend themselves to men of science," neither John Noakes nor Thomas Styles knowing more about the opinions of men of science than they do about the subject of the treatise whose leaves they have perhaps just cut, but quite possibly not.

* * *

THERE is a mistake in my article on earthquakes (KNOWLEDGE for November, p. 2) by which my argument about the pressure of the atmosphere is badly weakened. I had calculated the difference of pressure for two inches change in the mercurial barometer. But while the article was waiting to be sent off to England, I received a telegram from the editor of the *North American Review* asking me to send him an article on the earthquake, and in that article I dealt with a difference of only one inch in the barometer. (The article appeared in the October number of that magazine.) It occurred to me then that it would be far better to adopt the same difference in the article I had written for KNOWLEDGE. I supposed I had made the necessary corrections; but I remember a visitor called while I was making up matter for KNOWLEDGE, and I can only suppose that I was interrupted after I had halved the pressures, and before I had halved the differences in the barometer. If the reader will complete the alterations at p. 2 by writing one inch for two inches throughout, the statements will be made correct. The strength of the argument will be doubled—not that I think this greatly matters, as 100 millions of tons are as far beyond our power of conception as 200 millions. Still, it is well to be accurate in such statements. My wish to be moderate led to the mistake.

* * *

A CORRESPONDENT referring to KNOWLEDGE (p. 16), Nov. 1, 1886, says:—

> It was not Augustine but Tertullian who said "credo quia impossibile est." The expression occurs somewhere in his treatise "De Carne." I have not the exact reference at hand, but the passage is well known.

* * *

THE correction is just. I was for the moment thinking of Augustine in another connection. His special weakness before, as he puts it, "an incredible conflagration was enkindled within him" by the treatises of divers Platonists, was to require demonstration of things spiritual, not merely to be shown they were possible, far less to know they were impossible, before he accepted them with fulness of faith. In his tract "De utilitate credendi" Augustine came near Tertullian's paradox in the "De Carne Christi." Augustine is, of course, the greater of the two, though he might have written even such a saying as Tertullian's, seeing that, as was well said of him, he sports with Punic arguments, fearing to sicken the reader with tedium of his verbosity (*lectorem ne multiloquii tædio fastidiat, Punicis quibusdam argutiis recreare solet*).

* * *

ANOTHER correspondent writes as follows:—

> You say in KNOWLEDGE, July 1 (in article on Americanisms) that "*Dumpy*, for sad, is about as old English as can well be," which may be true enough, although I am not aware of its occurrence in any writer earlier than about 1530–40: but you are unquestionably in error in quoting the ballad of "Chevy Chase" as evidence of its antiquity, for the old *original* ballad (written probably not long after the battle, which was fought in 1388) has nothing whatever about "dumps" and Witherington fighting "on his stumps." The lines you mention are only to be found in the modernised version, which was certainly not made till some time after 1600, and [is] therefore no authority on "old English."

I am obliged for the note; but it involves no correction. The beginning of the seventeenth century would be quite old enough to show that "in the dumps" and "dumpy" are not Americanisms but old English. In reality the usage must be much older. I suppose the passage referred to as belonging to about 1530–1540, is Surrey's

My sinews dull in dumps I stand.

(Surrey died in 1547.) Of course this use of the word by Surrey shows that it was a familiar word in his day, and it may fairly be regarded as already an old word then. But as a matter of fact, its derivation from the Norse *domp* or *dump* would suffice to prove that it is Old English as well as old English, which last was all I said of it. "The dumps" would be equivalent to "the vapours." Chaucer in the "Nonnes Preestes Tale" speaks of one who needs purging "of melancholie," as "replete of humours hote." Dumps, i.e. damps, humours, vapours, all equally imply gloom.

* * *

The verse about Witherington in the ancient version of "Chevy Chase" (which I have long known by heart), runs thus:—

For Witherington my heart was wae,
  That ever he slaine should be:
For when both his legs were hewn in two,
  Yet he kneel'd and fought on his knee.

(The poet seems to have striven to make Witherington some amends by throwing in an extra foot in each of the last two lines.) In the comparatively modern version, quoted by Addison in apparent ignorance of any older one, we find Witherington's sad lot dealt with less poetically:—

For Witherington needs must I wail,
  As one in doleful dumps:
For when his legs were smitten off,
  He fought upon his stumps.

* * *

We shall do such of our readers as may not have seen the December number of the *Fortnightly Review* a service by calling their serious attention to Professor Huxley's article on "Science and Morals" in that journal. It is a reply to a charge by Mr. Lilly that the Professor, together with Mr. Herbert Spencer and the late Professor Clifford, agree in setting aside as unverifiable everything which the senses cannot verify, or which lies beyond the bounds of physical science, or which cannot be analysed in the laboratory. If Mr. Lilly has read with due care and comprehension Professor Huxley's essays on "Descartes" and "Berkeley," on "Sensation and the Sensiferous Organs," and notably the celebrated essay on the "Physical Basis of Life," it is difficult to acquit him of wilful misrepresentation of their writer's consistent attitude towards what is commonly understood by materialism. Professor Huxley has, however, an easy victory, and we are inclined to thank Mr. Lilley for having educed a manifesto as to the non-atheistic and non-spiritualistic character of science, truly so-called, the permanent value of which cannot be overrated. The paper is worth reading for its crispness, clearness, and dignity of style alone, and as to the matter, let it be read and re-read until it is thoroughly assimilated.

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Reviews.

The Methods of Glass-Blowing. By W. A. Shenstone. (London: Rivingtons. 1886.)—With the exception of the directions given in a treatise which appeared many years ago, and then only existed in the form of two or three unbound sheets, nothing worthy of the name of instructions in glass-blowing have appeared since those given by Faraday in his "Chemical Manipulation," first published in 1827. Mr. Shenstone then has supplied a very real want in the little book before us, and has earned the gratitude of all students of chemistry and physics by his simple and well-illustrated description of the methods adopted in the construction of all such glass apparatus as is ordinarily in use in the laboratory. He begins by describing the few and simple tools and materials requisite; explains the difference between lead glass and soda glass; and then initiates the beginner in the simple operations of cutting, bending, widening, and piercing tubes, and teaches him how to blow bulbs and grind stoppers. In a subsequent chapter the knowledge thus acquired is directed to the production of complicated pieces of apparatus, and the work concludes with an account of the way in which glass vessels and tubes are graduated and calibrated. An appendix gives full-sized sectional diagrams of the various glass tubes purchasable, with their trade numeral designations appended. We have two trivial faults to find with this capital little book. The first is, that its author's description of the blowpipe and its adjuncts applies solely to that form in which gas is used, and is, therefore, of use only to those resident in towns. The second complaint we have to make is that every measure in the book is given in millimètres, centimètres, and the like, the honest English inch being as absolutely ignored as the Chinese chid. When the metric system is made compulsory in this country, it will be quite time enough to make this cheap display of learning.

Circular Work in Carpentry and Joinery. By George Collings. Weale's Series. (London: Crosby Lockwood & Co. 1886.)—Mr. Collings has made a real contribution to technical education in the work before us; and the joiner who will thoroughly master its contents will possess an amount of knowledge but too rare among his *confrères*, and hence be in a position to demand the highest remuneration that his trade affords. Both the theory and practice of curved work in timber are explained intelligently and intelligibly by our author, who, beginning with the most simple examples of single curvature (such, for instance, as segment-headed window frames and the like), leads his pupil through others of gradually increasing complexity to such masterpieces of carpentry as domes, and ogee and apsidal roofs. Mr. Collings's mathematical illustrations of the principles underlying the construction of the various pieces of work he describes are in no case beyond the apprehension of any moderately well-educated artificer; and, in short, both theoretically and practically, his book leaves nothing to be desired. But we do wish that he would not write minutes and seconds of arc for feet and inches.

How to develop General Vocal Power. By J. P. Sandlands, M.A. (London: Sampson Low, Marston, Searle, & Rivington. 1886.)—While primarily, apparently, addressed to stammerers, for whose cure the major part of the exercises it contains are intended, Mr. Sandlands' volume may also be recommended to all who wish to read distinctly and impressively. His vocal gymnastics seem to be well adapted at once to remove vocal impediments in those suffering from defective articulation, and to improve declamatory power in those not so afflicted. It may be profitably studied by both the stammerer and the would-be orator.

Through Dark to Light. By A. EUBULE-EVANS. (London: Wyman & Sons. 1886.)—In a series of detached poems, the author of "Through Dark to Light" gives a picture of the passage of the Soul from Pessimism through suspended judgment to Optimism. His imagery in places is fine, and his versification very superior indeed to the mass of rhyme which flows so copiously from the press nowadays. Whether, though, his logic is equal to his poetry, the reader must judge for himself.

Heroes of Science. Physicists. By WM. GARNETT, M.A., D.C.L. (London: Society for Promoting Christian Knowledge.)—The "Heroes" whose biographies are given in Dr. Garnett's most readable and pleasant volume are Robert Boyle, Benjamin Franklin, Henry Cavendish, Count Rumford, Thomas Young, Michael Faraday, and James Clerk Maxwell—men sufficiently removed from each other in time, social position, and surroundings to render them typical. One excellent feature in the work before us is that its author contrives to interweave an account of the discoveries of the men whose lives he is writing with merely biographical detail proper, thus rendering his essays at once valuable and interesting. It is sad to think that the results of Cavendish's marvellously exact experiments in determining quantitatively the effects of electricity remained buried in manuscript for nearly ninety years, and that Faraday, in total ignorance of their existence, went over a great deal of the ground previously traversed by his predecessor—only, of course, to rediscover what had been established in the last century. Surely this affords a pregnant illustration of the evil attendant on the suppression or long postponement of the appearance of scientific memoirs. It was our intention to have quoted certain passages from more than one of the chapters in Dr. Garnett's book, but we will not forestall the pleasure of the reader (whom we heartily recommend to obtain it) by doing so. Anyone seeking for an appropriate Christmas present for an intelligent youth could hardly do better than purchase this new volume of the "Heroes of Science" straightway.

Electricity in the Service of Man. From the German of Dr. A. R. VON URBANITZKY. Edited by R. WORMELL, D.Sc., M.A. With an Introduction by JOHN PERRY, M.E., F.R.S. (London: Cassell & Co. 1886.)—In the excellent and very interesting introduction prefixed to the work whose title heads this notice, Professor Perry invites attention to the noteworthy fact that, prior to about the year 1870, there were really no text-books on the *science* of electricity. Works in vogue prior to that date contained, it is true, recapitulations of Franklin's speculations on the nature of electricity, descriptions of electrical machines and voltaic batteries, and of the pretty and brilliant experiments which might be performed by their aid, &c.; though, as he proceeds to say, such volumes were usually only redeemed from worthlessness by some account being given of Faraday's experiments; concerning which readers found that the main outcome of Faraday's work was the Ruhmkorff induction coil, whose important function was to illuminate Geissler's tubes for children's parties. How Dr. Everett, Sir William Thomson, Fleeming Jenkin, and Clerk Maxwell showed in what manner measurement and calculation could be applied to the elucidation of electrical phenomena, and how thenceforth invention and discovery proceeded *pari passu* with increased theoretical knowledge, is forcibly pointed out. Mr. Perry then goes on to elucidate the fundamental idea of "potential," and, by reasoning analogically from the behaviour of flowing water, to show the difference between electricity and electrical energy; concluding with a table of the various electrical magnitudes. This model preliminary discourse forms, however, a mere short preface to Dr. von Urbanitzky's practically exhaustive treatise, which forms a true monument of German skill, patience and thoroughness, occupying, as it does, 845 pretty closely printed pages, and containing no less than 836 well-executed wood engravings. Of these pages, 224 are devoted to the history and principles of electricity and magnetism, and the student, being supposed to have mastered them, is then introduced to the technology of electricity, to which the remainder of the work is devoted. Here will be found the most minute description of the various apparatus employed in rendering electricity subservient to economical purposes; and the general reader may familiarise himself with the construction and use of the different forms of dynamo-machine, with those of the electric telegraph, telephone, microphone, and phonograph, with every variety of electric lighting, with the apparatus employed in electro-metallurgy, with the utilisation of electricity as a motor, and, in short, with those numerous practical applications of electricity to the wants of our daily life which are becoming so rapidly more and more important and frequent. This is a book without which no physical library can be held to be complete, containing as it does between its two covers the sum and substance of numerous volumes. To the student it may be commended as an admirably full and clear introduction to the science and art of electricity; while to the advanced electrician it will be found of almost equal value as a book of reference. It is furnished with that desideratum a capital index.

Handbook of Acoustics. By T. F. HARRIS, B.Sc., F.C.S. (London: J. Curwen & Sons.)—Mr. Harris has produced a very thorough little book, and within the compass of 247 pages contrived to impart, in simple and perspicuous language, a large amount of information on the subject of acoustics generally. Although primarily addressed apparently to those studying the theory of music, a large part of the volume must possess equal interest for the student of general physics. Our author intimates in his preface that a mastery of the contents of his work will enable a candidate to work papers in certain examinations. We think (seeing what the word "examination" ordinarily connotes) that he does himself a certain amount of injustice in this. His "Handbook of Acoustics" is much too good to be used as a mere cram-book.

Cassell's Public School French Reader. By GUILLAUME S. CONRAD. (London, Paris, New York, and Melbourne: Cassell & Co.)—This graduated series of exercises for reading exhibits certain alterations and modifications, typographical and otherwise, which we cannot but regard as improvements on previous works of a similar character. Certainly they ought to enable the beginner to read French better and more intelligently than he is now taught to do.

Watch and Clockmakers' Handbook. By F. J. BRITTEN. Sixth edition. (London: W. Kent & Co. New York: E. & F. N. Spon.)—Very little more than two years have elapsed since we spoke in words of commendation of the first edition of Mr. Britten's excellent handbook (KNOWLEDGE, vol. v., p. 230), and already the sixth edition is on our table. Nor, considering the care with which its large amount of heterogeneous contents is brought up to date, is this to be wondered at, and we trust that even the twentieth edition may yet reach us for notice.

Illustrated Lectures on Ambulance Work. By R. LAWTON ROBERTS, M.D. Second edition. (London: H. K. Lewis. 1886.)—Here is the second edition of another book, admirable in a very different way to that just noticed; the first edition of which we have also previously reviewed (KNOWLEDGE, vol. viii., p. 53). We can only here reiterate the praise which we bestowed on Dr. Roberts's work when it first appeared, and add that in its latest issue it has been partly remodelled, and that a good deal of fresh matter, together with six new illustrations, have been added. This little volume addresses everybody who is ever likely to suffer from an accident or to be present when one happens; and its careful study may save many a precious life.

BOOKS FOR BOYS.

Charlie Lucken at School and College. By Rev. H. C. Adams. (Hodder & Stoughton.)—The incidents of this story of school life are laid in the early part of the present century, the ugly social troubles of which are vividly portrayed. Apart from these, there is abundant excitement in the narrative to ensure it a welcome among books for Christmas holiday reading, while the name of the author is guarantee for the absence of mawkishness and the presence of wholesome tone.

A Flood that led on to Fortune. By Old Boomerang. (Hodder & Stoughton.)—This is a stirring story of the battle of man against nature in the great rainfall of 1861 by a writer who has long held the field as a graphic narrator of life among the Australian squatters. Both works are well illustrated and attractively bound. The same commendation as to their get-up applies to the books of the season issued by Messrs. Blackie & Son, who are in their accustomed front place with a batch of capital stories. Among these we may give prominent welcome to Mr. Henty's *With Wolfe in Canada*, which, with one Jim Walshman, smuggler, sailor, and soldier, as the hero, tells the story of our victorious struggle—charged with momentous issues—against the French for supremacy in the New World. *Reefer and Rifleman*, by J. Percy Groves, is a tale of the two services in the early years of this century, with plenty of adventure in humorous setting. *Tales of Captivity and Exile* is concerned with the more sombre but interesting record, from antiquity to modern times, of the imprisonment or exile of men, good and bad alike, who had the courage of their convictions, and suffered accordingly. The same publishers have issued handsome reprints of Mr. George Macdonald's *At the Back of the North Wind* and *Ranald Bannerman's Boyhood*, while for the children who have found delight in these standard favourites a feast of good things is provided in Miss Alice Corkran's *Down the Snow Stairs*. These lead to Dreamland, where—as in the Persian Avesta, the soul of the good man is confronted by a fair maiden, who reveals herself as his good thoughts and deeds in life; or, as in the fabled hell, the vices of men pursue them like Nemesis—Kitty, the heroine, meets troops of children to whom is meted that which they measured out to dumb and weaker things, till Love sets them free. But the moral is never obtruded to the obscuring of the story, the charm of which is increased by Mr. Gordon Browne's fantastic illustrations.

Turning from fiction to sober history, we may commend *True Stories from English History* (Griffith & Farran), selected from writers of all schools—the Venerable Bede, Froissart, Macaulay, and Thackeray—by Mr. Oscar Browning, himself an historical student of no mean repute. In *Outlines of Jewish History* (Longmans) Lady Magnus tells the history of her people from Bible times to the present day, and we are glad to have the momentous events stretching from the period of the Exile to the period of modern toleration grouped in convenient compass and presented in agreeable style. Such compression of vast material is more laborious than its expansion, and Lady Magnus has done her task extremely well. The outline sketch of Spinoza is admirable, and the significance of his philosophy on all subsequent thought pointed out.

The Story of the Nations.—Carthage. By Professor A. J. Church. (Fisher Unwin.)—The learned author, whose familiar renderings of Homer and other ancients place the non-classical reader under no slight obligation to him, remarks that "the story of Carthage is mainly a story of war," and consequently the narrative of her offensive and defensive battles by sea and land, till her final conquest and demolition by Rome, fill nine-tenths of this book. The remaining tenth tells us what little can be known about the internal history of the city, her institutions, her commerce, and her art, borrowed, as this was, like that of Phœnicia, from Greece. The work could not have been entrusted to more competent hands, and will take equal rank with its predecessors in this useful series.

Legends and Popular Tales of the Basque People. By Mariana Monteiro. (Fisher Unwin.)—These legends are full enough of the marvellous to make the book, with its weird illustrations, popular; but from the standpoint of folk-lore it must be pronounced a disappointment. The tales have lost their simplicity of diction, and the spontaneity which is their charm, through recasting into literary form, while the absence of any comparative treatment leaves us in the dark as to their historical relation. The book may, however, be read with advantage as supplemental to the collection of legends of the same unique and interesting people gathered by the Rev. Wentworth Webster, and published in 1877.

The History of the Forty Vezirs; or, the Story of the Forty Morns and Eves. Translated by E. J. W. Gibb, M.R.A.S. (George Redway.)—The history of this celebrated Turkish romance has been fully discussed by Mr. Clouston in his "Book of Sindibad," and we await with interest Messrs. Blackwood's publication of that author's forthcoming work on the profoundly interesting subject of the Migrations and Transformations of Popular Tales and Fictions. Meantime, we are grateful to Mr. Gibb for the present collection, which has for its well-worn and ungallant theme the weakness and frailties of woman. The framework of the story is the unjust accusations of a spiteful queen against her stepson, whom the king orders to be slain, but whose death is averted by the wisdom of the king's vezirs. Every night the crafty woman tells the king a story which incites him to slay the prince, and in the morning, when he is led forth to execution, a vezir tells a story which calms the king's anger. This goes on for "forty morns and eves," when the innocence of the prince is proved, and the queen's deceit exposed. Mr. Gibb's translation is pleasant to read, and an appendix of supplemental stories, together with tables of their place in the various texts, make his work a valuable addition to our materials for the study of Oriental romance.

Luck or Cunning? By Samuel Butler. (Trübner & Co.)—"Op. 8" is, according to its supplemental title, "an attempt to throw additional light upon the late Mr. Charles Darwin's Theory of Natural Selection." It should rather be described as an attempt to throw additional vitriol on Mr. Darwin's reputation as a man of science, and, still more, as a man of honour. Mr. Butler, as is well known, has an old-standing quarrel with Mr. Darwin, and with those who speak well of him, the grounds of which have been stated *ad nauseam* in Ops. 3 to 5, and in "Selections from Ops. 1–6." And we are at a loss to understand what purpose is served by this wearying reiteration of a charge which it seems to us was disproved in a letter from Mr. Darwin himself, published in Mr. Butler's "Op. 5," "Unconscious Memory." Certain parts of Mr. Butler's "Life and Habit," erratic as were its conclusions, made us expect great things from him, had he submitted his fantastic imagination to the rigidity of biological fact. But he has disappointed us, and we regret that so extremely clever a man, whose writings are full of good and true things pithily said, should obscure their goodness and truth under the verbiage of personalities, which disfigure this book even more than his earlier works.

Messrs. Longmans send us a choicely printed and cheap volume of selections from JEAN INGELOW, under the title of *Lyrical and Other Poems*. We are glad to have some old favourites in this compendious form. We have also on our table *The Anatomy of Negation*, by EDGAR SALTUS (Williams and Norgate); *The Parental Don't*; and *Bazaars and Christianity* (WALTER SCOTT); *Life after Death?* by F. W. NEWMAN (Trübner & Co.); Mr. COLE's always instructive *Microscopical Studies*; *The Illustrated Handbook of Victoria* (Ferres, Melbourne); *A Froebel Reading Primer*, by A. C. BEALE (Sonnenschein & Co.); *The British Almanac and Companion for* 1887; *The Antiquarian*; *The Century Magazine*, the most valuable feature of which is the Life of President Lincoln, by "Pike Ballad" Colonel Hay and J. G. Nicolay; *Longman's Magazine*, in which Miss Orme fails to meet the powerful arguments of Dr. Richardson as to the necessity of woman, if she elects to do man's work, resigning the normal functions of maternity.

THE FACE OF THE SKY FOR JANUARY.

IN the present quiescent state of the solar surface the sun affords but scant interest to the observer with the telescope. He is in perigee—*i.e.*, the earth is at the nearest point in her orbit to him—at 8 P.M. on January 2. Hence at this date his disc is apparently larger than at any other time. The night sky is shown on map i. of "The Stars in their Seasons." Minima of that remarkable variable star Algol ("The Stars in their Seasons," map xii.) will happen at 6h. 36m. P.M. on January 1, at 11h. 29m. P.M. on the 18th, at 8h. 18m. P.M. on the 21st, and at 5h. 7m. P.M. on the 24th, and on other dates, when it will be unobservable by the ordinary amateur. Mercury is a morning star throughout January, and is, moreover, so very low down, and so close to the sun towards the end of the month as to be practically invisible. Venus is an evening star. During the earlier part of January she is, to all intents and purposes, invisible too; but towards the end of the month, on a perfectly clear evening, she may be caught after sunset glittering above the horizon in the S.W. by W. Mars is absolutely invisible. Jupiter is a morning star. As he does not rise until after 2h. 15m. A.M. at the beginning of January, nor until half an hour after midnight on the 31st, he can hardly yet be regarded as an object of observation for the ordinary amateur. Saturn, on the contrary, is admirably placed, coming, as he does, into opposition to the sun at 2 P.M. on the 9th. He is in fact visible all night long, and during the major part of it is most favourably placed, his meridian altitude in London exceeding 61°. The attentive observer will note the slight closing of his ring system, and that the south pole of the planet no longer falls within Cassini's division in the rings. Saturn is in Gemini ("The Stars in their Seasons," map ii.) to the south of Castor and Pollux. Towards the end of the month he will be in the same telescopic field as that well-known double star δ Geminorum. Uranus, as a morning star, will scarcely come into view for our purpose for the next month or two: but Neptune continues visible during all the earlier hours of the night. He is situated in a blank part of the sky, a little less than 6½° south of the Pleiades ("The Stars in their Seasons," map i.). The moon enters her first quarter 20.5 minutes after noon on the 2nd, and is full at 10h. 32.3m. on the night of the 9th. She enters her last quarter at 3h. 22m. P.M. on the 16th, and is new at 3h. 1.1m in the early morning of the 24th. No less than fourteen occultations of fixed stars by the moon will occur at convenient hours for the amateur during the present month, in addition to others during the morning ones. On January 4, μ Ceti, a star of the 4th magnitude, will disappear at the moon's dark limb at 8h. 28m. P.M. at an angle of 87° from her vertex. It will reappear at her bright limb at 9h. 33m. P.M. at a vertical angle of 348°. On the 5th *f* Tauri, another 4th magnitude star, will disappear at the dark limb of the moon at 5h. 21m. P.M. at a vertical angle of 48°, to reappear at her bright limb at 6h. 21m. P.M. at any angle from her vertex of 293°. On the 6th, 71 Tauri, of the 6th magnitude, will disappear at the dark limb of the moon at 6h. 50m. P.M. at an angle of 359° from her vertex. It will reappear at 7h. 7m. P.M. at her bright limb at a vertical angle of 334°. Later at 7h. 17m. P.M. θ^1 Tauri and θ^2 Tauri, both stars of the 4½th magnitude will disappear at the moon's dark limb at 7h. 47m. and 7h. 54m P.M. respectively; the former at an angle of 68°, and the latter at one of 47° from her vertex; θ^1 Tauri will reappear at 9h. 2m. P.M., and θ^2 Tauri at 8h. 55m. P.M. at the bright limb; θ^1 at a vertical angle of 295°; θ^2 at one of 316°. Later, the 5th magnitude star B.A.C. 1391 will disappear at the dark limb of the moon at 9h. 2m. P.M. at an angle of 108° from her vertex, reappearing at her bright limb at 10h. 19m. P.M. at an angle from her vertex of 289°. Finally, the most important occultation of all on this prolific night will occur 17 minutes after midnight, at which hour Aldebaran will disappear at the dark limb at a vertical angle of 165°. It will reappear the next morning at 1h. 15m. at the bright limb, at an angle of 283° from the moon's vertex. The student should endeavour particularly to observe this occultation both at the disappearance and reappearance of the star, inasmuch as the curious phenomena of projection on the moon's disc, &c., during occultations have been nearly always recorded in connection with this particular one. On the 7th, 115 Tauri, a 6th magnitude star, will disappear at the dark limb at 8h. 53m. P.M., at a vertical angle of 95°, reappearing at the bright limb at 10h. 6m. P.M., at an angle of 261° from the moon's vertex. On the 9th, B.A.C. 2132, of the 6½th magnitude, will disappear at 7h. 6m. P.M., at an angle from the vertex of the moon of 106°. It will reappear at 7h. 40m. P.M., at a vertical angle of 175°. The disappearance will in reality occur at the dark limb of the moon, but she will be so nearly full that the effect will be that both limbs will appear to be bright at disappearance as well as at reappearance. On the 12th, 45 Leonis, a star of the 6th magnitude, will disappear at the moon's bright limb at 9h. 11m. P.M., at a vertical angle of 83°; to reappear at her dark limb at 9h. 50m. P.M., at an angle of 171° from her vertex. Later on, ρ Leonis, a 4th magnitude star, will disappear at the bright limb at 11h. 29m. P.M., at an angle of 61° from the lunar vertex. It will reappear 30 minutes after midnight at the dark limb, at a vertical angle of 199°. Passing over several occultations which happen during the morning hours, we come to the 28th, on which date 4 Ceti, a 6th magnitude star, will disappear at the dark limb of the moon at 7h. 16m. P.M. at an angle of 179° from her vertex. It will reappear at her bright limb at 8h. 13m. P.M., at an angle from her vertex of 296°. Subsequently, 5 Ceti, another 6th magnitude star, will disappear at the dark limb at 7h. 42m P.M., at an angle of 196° from her vertex, to reappear at 8h. 26m. P.M. at a vertical angle of 281°. Finally, on the 30th, ν Piscium, a star of the 4½th magnitude, will disappear at the moon's dark limb at 9h 24m. P.M., at a vertical angle of 185°, and will reappear at the bright limb at 10h. 15m. P.M., at an angle of 289° from the vertex of the moon. At noon on January 1 the moon is in Pisces ("The Seasons Pictured," plate xxii.); and about 6 o'clock in the evening she enters the extreme confines of Cetus, whence she re-emerges into Pisces at about the same hour on the 2nd. She travels through Pisces until 10 P.M. on the 3rd, when she arrives at the most northerly outlier of Cetus, and again enters that constellation. When she finally quits it at noon on the 4th it is to pass into Aries. Her passage through the last-named constellation occupies her until 4 P.M. on the 5th, at which hour she crosses into Taurus ("The Seasons Pictured," plate xxiii.). In her journey across Taurus she arrives at 8 A.M. on the 8th on the boundary of the narrow northern part of Orion. When by 7 o'clock the same evening she has traversed this, it is to pass into Gemini ("The Seasons Pictured," plate xxiv.). She is travelling across Gemini until 9 A.M. on the 10th, when she crosses into Cancer. It takes her until 7h. 30m. P.M. on the 11th to traverse the last-named constellation, which at that hour she quits for Leo. Here she remains until 5h. 30m. A.M. on the 14th, and then enters Virgo ("The Seasons Pictured," plate xxv.). Her passage across Virgo occupies until 8h. A.M. on the 17th, when she crosses the boundary into Libra ("The Seasons Pictured," plate xxvi.) In her journey through the constellation last named she arrives, at 3h. A.M. on the 19th, at the edge of the narrow northern spike of Scorpio. Nine hours and a half later she has passed over this and entered Ophiuchus. She leaves Ophiuchus for Sagittarius at 7h. A.M. on the 21st, and Sagittarius, in turn, for Capricornus, at 6h. P.M. on the 23rd ("The Seasons Pictured," plate xxi.). She is travelling through Capricornus until 9h. P.M. on the 24th, at which hour she enters Aquarius, a constellation which she never leaves until 10h. P.M. on the 27th; to pass into Pisces ("The Seasons Pictured," plate xxii.) In her journey through this great straggling constellation she (just as at the beginning of the month) passes into a part of Cetus at midnight on the 28th, to re-enter Pisces at 2h. A.M. on the 30th. At 5h. 30 A.M. on the 31st she also, for the second time this month, re-enters a part of Cetus, to come out in Aries at 11h. P.M. on the 31st ("The Seasons Pictured," plate xxiii.). She is, of course, in Aries when our notes terminate.

Our Whist Column.

BY "FIVE OF CLUBS."

MATHEWS ON WHIST.

(Continued from page 22.)

BEFORE you play a card, sort your hand carefully, look at the trump card, and consider the score of the game and strength of your hand. Form your plan on the probable situation of the cards, being prepared, however, to change the plan should anything fall to indicate a different one. After deciding on your plan, never look at your hand till it is your turn to play. Without attention to the board, no maxims in practice can ever make a tolerable whist-player.

Never lead a card without a reason. It is better to have a wrong reason than to fall into a habit of playing at random.

At the commencement of a game, if you have a good hand, or if your adversaries are considerably advanced in the score, play a bold game: otherwise a more cautious one. [This rule requires some modification. If you have a good hand and you and your partner are considerably advanced in the score, it is better to play a cautious game, because the object of a bold game is to get many tricks, and you want but few—on the supposition—to win. Again, if you have a poor hand, and your adversaries are considerably advanced in the score, your first object should be to save the game, which requires cautious play, directed rather to securing the odd trick, or so many tricks as may be necessary to prevent the enemy going out, than to secure a winning game. The rule should rather run, then—If the enemy are well advanced in the score, and you have a good hand, so that there is little danger of losing, play a bold game; but if your hand is bad and the enemy well advanced, play more cautiously. This I imagine is what Mathews really meant, as otherwise his rule as a whole (with its perplexing "if otherwise") is altogether misleading and barely intelligible.]

The best leads are from sequences of three cards or more. If you have none lead [in general] from your most numerous suit. It is seldom right to lead from a suit in which you have a tenace. With Ace, Queen, &c., of one suit, King, Knave, &c., of a second, and the third a weak one, the best play is to lead from the last. [This is no longer the opinion of the most experienced whist-players, who under such circumstances would lead a small card from the lowest suit, or the Ace if holding five in that suit.] If strong in trumps, lead rather from a suit headed by a King than a Queen. But with three or four small trumps, I should prefer leading from a single card to opening a long weak suit.

It is hardly necessary to point out that while the old school seldom led a singleton, except with length in trumps, regarding it as a dangerous lead, the modern school objects to the singleton lead under nearly all circumstances. But the modern school would be more in sympathy with Mathews than with the old school, for Mathews's idea clearly is that with a few small trumps and a bad hand you can lose nothing by ruffing if you get the chance, and may make a trick or two, or possibly find your partner able to join in a cross-ruff. The chief danger, that which has practically divided the modern school against the singleton lead, even under these comparatively favourable conditions, is this—the chances when you are weak in trumps and in hand are that the enemy's combined strength surpasses your partner's, both in trumps and in the suit in which you hold a singleton; if this be the case, your singleton lead shows them just what to do to make a long score. They extract trumps, use the suit in which they have length and strength effectively against you and your partner, and probably render any other good cards he may have in other suits useless to him, while you are powerless to help him. By keeping back your singleton, you keep back also the knowledge necessary to put them in the way of thus using their strength for your destruction.

Another case in which Mathews considers that you may lead a singleton seems less obviously objectionable.

As I have ventured to recommend occasional deviations from what is considered one of the classic maxims, advising the lead from a single card without that strength in trumps hitherto [he refers, of course, to the oldest of old schools] judged indispensable to justify it, I give the reasons that influence my opinion in favour of this practice, with those generally alleged against it, leaving the reader to determine between them. Two objections are made, which, it cannot be denied, may be, and are at times, justified by the event. The first is that, if your partner has the King of the suit guarded, and the Ace behind it, he loses it; which would not be the case if the lead came from the adversary. The second and most material is, that your partner, if he wins the trick, may lead out trumps, on the supposition that it is your strong suit; or the adversaries may lead out trumps, suspecting your purpose. On the other hand, the constant and certain advantages are the preservation of the tenace in the two other suits—which I suppose you to have [this, however, was not what his prior advice as worded would have suggested]—and the probable one of making your small trumps, which you would not otherwise do. If the leader has four small trumps; Ace, Queen, &c., of the second suit; King, Knave, &c., of a third; and a single card of the fourth, I am of opinion that the chance of winning by leading the single card is much greater than that of losing tricks; and I appeal to those who are in the habit of attending whist-tables whether they do not frequently see the players who proceed more exactly according to the maxims of Hoyle, &c., after losing the game, try to demonstrate that this ought not to have happened, and that they have been vanquished by the bad, not by the good, play of their adversaries. I do not recommend, in general, leading from single cards, unless very strong in trumps; but, with such cards as I have mentioned, I am convinced it may occasionally be done with very great, though not with certain, advantage.

Of course the case here considered is very different from that which had before been mentioned. It may be admitted that the singleton lead from such a hand would be safe, or even in playing for the odd trick, good policy. The fault of the play would reside not in its undue daring, but in its undue caution. With such a hand a trump lead would be the best. You have necessarily a long suit, if not two, and both well guarded. Should your partner not be strong in trumps, or well guarded in your singleton suit, you remain with three, or at the least with two, trumps wherewith to ruff the singleton suit—and you have all the better chance of doing this, that the enemy, noting your trump lead, will not be anxious to extract trumps. But the chances are that either your partner has strength in trumps, or he has at least some strength in your short suit: in either case your lead is a safe one. Should he have any strength in trumps, and two rounds be taken out, you and he have an excellent chance of making a good score.

[We shall see presently under what conditions Mathews recommends the trump lead; but now pass on to consider his detailed advice in regard to the leads.]

With Ace, King, Knave, and three small trumps, play out the Ace and King; but with only two small trumps, play the King, and wait for the finesse of the Knave. In other suits, without great strength in trumps, or with the chance of making a particular point [if the finesse is successful] do not wait for the finesse. [Mathews here, and in the next rule, advises the Ace lead first, as a general rule—for the lead of the King is only authorised by him when you propose to wait for the finesse, and when, therefore, it is necessary to show your partner you hold the leading card, and wish the suit led to you. He evidently considers that in plain suits, when you do not wish the suit returned, it is better to lead the Ace first.]

With Ace, King, and five others, lead the Ace in all suits; but with four or less, lead the lowest in trumps. [The rule is only changed in our time, in that the King is played from the head sequence in the former case, and the fourth best, or penultimate, in the latter, except by the staunch opponents of penultimate and American leads. We still adopt the point of strategy, leading a small card from Ace, King, and fewer than five small cards in trumps.]

With Ace, Queen, Knave, &c., lead the Ace in all suits. With Ace, Queen, ten, and others, in trumps lead a small one; but in plain suits, with Ace, Queen, ten, and two others, lead the Ace unless very strong in trumps. [Mathews so words the rule as to leave it in doubt whether he means in the last case Ace, Queen, ten, and three others, or Ace, Queen, and three small ones. Probably his rule was the same as ours—Ace first from Ace, Queen, and three small ones: only he notes the exception, which most of our modern books fail to mention, that with great strength in trumps you should lead a small card in the plain suit, whether you open the plain suit first or after taking out a round or two in trumps.]

With Ace, Knave, and small ones, lead the lowest in trumps. In other suits, with Ace, Knave, and more than two small ones, lead the Ace, unless very strong in trumps. [Sound advice, both as to rule and exception. It is clear my reading of the preceding rule is correct.]

With Ace and four small ones, lead the lowest in trumps; the Ace in plain suits, unless you are very strong in trumps. [With Ace and five small ones, lead a small card in trumps; but with six small cards, lead the Ace.]

(To be continued.)

Our Chess Column.

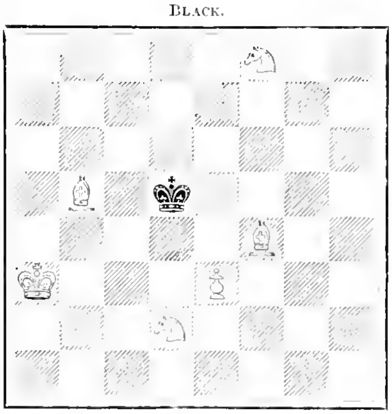
By "MEPHISTO."

REVERENCE for the past is not a characteristic trait of the present generation of chess players. We may, however, always find something interesting, to reward us for our pains in turning over the sere and yellow leaves of the chess literature of old. In looking backward for inspiration for the New Year's chess article, I made a virtue of necessity, which I am pleased to call reverence for the past. The necessity may, however, be practically explained by a remarkable falling off in the production of good chess in this country. This falling off can be accounted for partly by a large decrease in first-class play, owing to circumstances affecting some individuals who formerly played good chess professionally. Going still deeper into the causes of this failing, we are bound to come to the conclusion that the enthusiasm for chess which animated many of the great players of the past, and which, in connection with patient and laborious study, produced such fine results, is gradually disappearing. The pressure on man's mind is far more severe than it used to be formerly, and the demand on his physical energy in the struggle for life is so much greater, and as a man must possess an easy and free mind, and plenty of leisure time to pursue chess ardently, I have grave doubts whether we shall in this or the next generation find such noble votaries of chess as Philidor, Labourdonais, Staunton, MacDonnell, Bilguer, Van der Lasa, Andersen, Paulsen, Morphy, &c.

In looking over some curious examples of old compositions, I came across a very interesting and useful position, composed by a Cambridge man, given in the diagram below. In this problem a mate can be forced by any one of White's five pieces. There can be no more useful exercise than an attempt at solving this problem. In order to do so, we must conceive or find five different mating positions in this one problem, in itself an excellent practice; for, unless we first discover the possibility of a mate being given, we can never solve any problem; how to mate follows then of itself.

Here we have an excellent example, showing the power of pieces in certain positions, and their influence on the whole. No doubt good practice for problem composers who put pieces on the board, to make up a position with a light heart, without calculating other effects which they produce, creating double solutions, duals, &c.

BLACK.



WHITE.

The problem is—

1. White to mate in 4 moves with the Kt on B8.
2. " " 5 " " KB.
3. " " 5 " " P.
4. " " 6 " " Kt on Q2.
5. " " 8 " " QB.

I presume that the reader will make a prolonged effort to solve this problem. For the benefit and instruction of those not sufficiently acquainted with the method how to solve a problem, I hereby work out the solution, as a useful guide for future efforts in the same direction.

Now in order to find out No. 1, which is the most difficult, we must suppose that we do not know that the mate has to be given by the Kt on B8, but we must treat it simply as a four-mover. First of all we have to take a good survey of the relative position of the White pieces, and then of the Black K. We find the K can only move to B4, and in an open position like this it may safely be taken for granted that in order to mate in four moves, the White cannot afford to give Black much liberty after Black playing K to B4; we have also to provide against K × B and K to Kt3, which we obviously cannot allow. We see, therefore, that K to B4 is the move to counteract. We may have several tries at doing this. Kt to Q7 would not do, as that would open a still larger loophole for escape of the black K *via* K3, therefore we try 1. B to B7, K to B4. Now we must move the other B or protect him with 2. K to R4, K to Q4. But by looking at the position we find that we have not got more forward, for whether we move either Kt or P, the black K obtains more liberty. If we replace the position, therefore, we may attempt to cut off the retreat of the black K by 1. K to R4 and 2. K to R5; but here again we shall soon find that there is no mate possible in four moves. By making various efforts with the B's and the P, we shall also soon come to the conclusion that in order to mate in four moves the position must be disturbed as little as possible. There remains, therefore, but the Kt on Q2 available. We can undoubtedly cut off the K from B4 by Kt to Kt3, but then we allow K to K5. As we are, however, impressed with the conviction that we must prevent K to B4 if possible, we must look what we can do further after 1. Kt to Kt3, K to K5. It is certain we cannot allow Black's K to KB4 or KB6, and we see that 2. Kt to Q4 is the only move to prevent either; but as yet we have achieved nothing. Nevertheless, we are guided instinctively to make these moves, especially as the black K must now go back, and we know by experience that by so limiting the action of the K we are more likely to bring about a mating position. Feeling that in all probability we are on the right track, we must not easily be deterred, but seek to find a mating position. After 2 Kt to Q4, K to Q4 in looking for a mate, we soon find that if the white K were now on Kt4, we could mate by B to B6. Can we bring that about? No, for if 3. K to Kt4, K to K5, and there is no mate next move, although we can mate in 5 by 4. B to K2, K to Q4. 5. B to B3, mate. But then we must do it in four, and we feel that there cannot be any time for moving the K, therefore we replace the men and try again, nothing daunted. 1. Kt to Kt3, K to K5. 2. Kt to Q4, K to Q4. We see that the Kt on Q4 now protects the square on K6, which makes the Kt on B8 available. Supposing we try 3. Kt (B8) to K6, then K to K5, and there is no mate anywhere the same if 3. Kt (Q4) to K6, but there is still 3. Kt to Q7, then K to K5, and surely 4. Kt to B6 is mate.

Now this is a case where we could not see the mating position first, but where we had to weigh probabilities to lead us in the right direction, and then exhaust possibilities to find the solution, which is mostly the case with problems above three moves.

The other solutions are as follows:—

No. 2. To mate with KB in five moves:—

We have already found out in attempting to solve No. 1, namely, by 1. Kt to Kt3, K to K5. 2. Kt to Q4, K to Q4. 3. K to Kt4, K to K5. 4. B to B6, K to Q4. B to Kt7, mate. In this mate there are many duals; on the 4th move the B can move to three places or the Kt on B8 can make four different moves, after all of which the KB will be able to give mate. A mate can also be given by 3. Kt to Q7 or K6, K to K5. 4. K to Kt3 or Kt4, K to Q4. 5. B to B6, mate. There are also duals in the other solutions. The study of all these various duals will be useful exercise for anyone wishing to learn how to solve or construct a problem.

No. 3. To mate with the P in five moves:—

1. K to R4, K to B4. 2. B to B7, K to Q4. 3. B to Q7, K to B4. 4. Kt to K6 (ch), K to Q4. 5. P to K4, mate.

No. 4. To mate with the Kt on Q2 in six moves:—

1. K to R4, K to B4. 2. K to R5, K to Q4. 3. B to B7, K to B4. 4. Kt to K6 (ch), K to Q4. 5. Kt to B4 (ch), K to B4. 6. Kt on Q2 mates.

No. 5. To mate in eight moves with QB:—

1. K to R4, K to B4. 2. K to R5, K to Q4. 3. B to Q7, K to B4. 4. Kt to K6 (ch), K to Q4. 5. Kt to B7 (ch), K to B4. 6. Kt to Kt5, K to Q4. 7. P to K4 (ch), K to B4. 8. B mates.

J. C.—You are right. In KNOWLEDGE for November, Diagram p. 24, the Black Queen should be on Black's QR square, not on QR8.

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TENNYSON'S JUBILEE JEREMIAD.

"LOCKSLEY HALL," and again "Locksley Hall after Sixty Years"—in round numbers:—say since the time when the beneficent reign of the "first gentleman in Europe" came to an end, and the dignified sway of "our gallant sailor king," the father of many Fitzes, began. Our poet laureate, once peer of all the poets of his time—now a peer of the realm—has anticipated the year of Jubilee, as in duty bound, with many rhymed lines presenting the progress of his country during the fifty years (and a few years for William) over whose passage men are to rejoice this year of Jubilee.

Sad to say, the poet of the bay-leaved sherry cask, called on to bless the beneficent half century, seems more inclined to curse. He hints plainly—nay, more than plainly—that chaos has replaced cosmos. Whether there has been something "rotten in the state of Denmark," something wrong about the "beneficent sway" business, or whether (those being right who think that if England does well or if England does ill, is a matter altogether in England's own hands) England has not done so well for herself lately as she might, or whether, lastly, the new-old peer has found that all which glitters is not gold, certainly the poet laureate condemns the past half century and its products in terms by no means mild or measured. Carlyle with his Niagara-and-After screech was calm and complimentary compared with Tennyson. It is not a mere cataract, but cataclysmic chaos he sees; it is all "a sickening game," the "old dark ages back without the faith or hope," an age when "author, atheist, essayist, novelist, realist, and rhymester"

> Rip their brother's vices open, strip their own foul passions bare—
> Down with reticence, down with reverence—"Forward!"—naked let them stare;

the "budding rose of boyhood" is "fed with drainage of the sewer," "our maidens' fancies wallow in the troughs of Zolaism": in fine, the year of Jubilee finds us all in what a less elegant orator would call "a devil of a state." Surely if all this elegantly described, sickening, chaotic, foul, sewer-like, trough-wallowing abomination is real, our best provision for this year of Jubilee would be a goodly store of sackcloth and ashes. If our calm and gentle, purely writing poet laureate is right, the less Jubilee orators say about "beneficent sway" the better. If there has been sway at all, Tennyson assures us it has not been beneficent. If there has been beneficence there can have been no appreciable sway. If Tennyson is right, what considerable reason for celebrating a Jubilee remains? A nation can hardly be expected to rejoice because fifty years have passed since the "sailor king" left his fine Fitz-family fatherless. It can only be because those fifty years have been years of progress, due in some way or other to influences emanating from Balmoral, that we are going to rejoice—though, of course, celebrations of any sort must be a pleasant change for the weary drudges whom Tennyson holds in such contempt. But if our progress has been backwards, as he says, where does the rejoicing come in?

Why does our keen-sighted and even keener-nostrilled poet-peer see all this misery, this chaos, these foully-staring naked passions, these sewer-fed boys and trough-wallowing girls, where other men see in the same half century the usual mixture of good, bad, and indifferent in the nation, with some progress and especially a steady advance towards sober freedom? Why does he find "poor old heraldry" (which we could so well spare), "poor old history" (though history, at least, can hardly die), and "poor old poetry" (and very poor some old poetry is to be sure)—

> . . . Passing hence
> In the common deluge drowning old political common sense,

(which might have, at least, kept one of its extra feet on dry ground)? The whole trouble seems to lie in the extension of the suffrage by "tonguesters," who—

> Teach their flattered kings that only those who cannot read can rule.

These tonguesters, unnamed, it is, who—

> Pluck the mighty from their seat, but set no meek ones in their place,
> Pillory wisdom in their markets, pelt their offal at her face.

(Is *this* Zolaism? one wonders.) When it comes to asking who are the mighty who have been plucked down, our poet is wisely silent. He does not even tell us what meek ones might have been set in their place, but were not. Even when we ask, naturally, what these new electors have done to move his wrath, or how "the realm-ruining party" (is it, then, only a party matter after all?) have done ill, we get only some "Goosey-gander" rhymes about a cat and a lion: and after all the lion is but a carnivorous brute, while the cat, according to a poet who was more than the peer of all poets, is a harmless, necessary creature. Finally, however, we come on the real trouble:—

> Russia bursts our Indian barrier. Shall we fight her? shall we yield?
> Pause before you sound the trumpet! *Hear the voices from the field!*
> Those three hundred millions, under one imperial sceptre now,
> Shall we hold them? Shall we loose them? *Take the suffrage of the plough!*

All this, indeed, is very, very sad. Russia is an evil empire, we all know—a portentous power: and our imperial rule in India is a sacred charge. We may be a sewage-swallowing, trough-wallowing set at home, but we are purifying and ennobling our three hundred millions of Indians out yonder—*ours*, we know not why, and care not to ask how. History, arm-in-arm with heraldry, stirs poor old poetry to tell us we must sound the trumpet, and with pure and holy hands (casually armed with swords and repeating rifles) drive off those hordes of murderous, land-seizing Russians, needing only our sedulous scratching to be shown for the Tartars they are. But alas! before we can do all this for the benefit of—of—ah well, of Christianity and—and perhaps commerce, and to spread enlightenment, and so forth, and so forth—we are obliged, unfortunate that we are, to "hear the voices of the field," and "take the suffrage of the plough." Manifestly this is unfair and wrong. We may take our soldiers from the plough and drain the life blood of the field. What are the serfs for, but that? When, however, men begin to talk of hearing the drudges' voices—and alas! poor fellows, how indistinctly they often speak (mere mutterings, as it were)—or when we invite them to give their suffrage since they have suffered and it is they who will have to suffer, then our boasted freedom is only—says the peer poet—

Free to slay herself; is dying while they shout her name.

Assuredly the extension of the suffrage is not an unmixed good. Let the fault lie where it may, a large proportion of those to whom votes have recently been given are quite incapable of forming just opinions on the matters about which they are called on to vote. (Many are not more capable, though, who think themselves born legislators, and are really but several different sorts of born noodles.) Yet it was at any rate an attempt at justice—feeble and late, but still an attempt—to give our peasants a voice after borrowing from many of them their lives generation after generation, and from most of them all that makes life worth living. Nor need those fear who would have the labourers in our fields remain as simple and as stupid as of yore. It is to be feared the poor fellows will not soon learn better. Fifty years hence it will still be possible to say what Carlyle said of them fifty years ago, when he pictured the British village Dumdrudge, contemplating in place of thirty brisk useful peasants as many dead carcasses for which "it must anew shed tears." "Had these men"—these thirty and the thirty Russians slain *per contra*—"any quarrel? Busy as the Devil is, not the smallest! They lived far enough apart; were the entirest strangers; nay, in so wide a universe, there was even unconsciously, by commerce, some mutual helpfulness between them. How then? Simpleton! their governors had fallen out; and instead of shooting one another, had the cunning to make these poor blockheads shoot." No fear, old heraldry! Hope on, old history! And poor old poetry, be joyful once more! For many Jubilee seasons yet to come the world will not have to sorrow that—

The peasant cow should butt the lion passant from his field.

The Lion *Passant* has ever been *Guardant* too; the Lion *Rampant*, *gules* (*Ruby* though not always blushingly rubescent for peers, and *Mars* for princes as old heraldry enjoins) will long take care that the peasant cow, aye, and the peasant calf and sheep and lamb, nay, even the poor, trough-wallowing pig, shall duly provide for his noble though somewhat greedy maw. If he is no longer as of yore *armed and langued sanguine* it is only because teeth and claws and saignant tongue are hidden. Even the Jeremiah of this year of Jubilee will not persuade us that the peasant cow will quickly butt the lordly lion from his fields.

All this heraldic nonsense, it will be seen, brings in its own reply, almost as nonsensical as itself. If poor old heraldry teaches poor old poetry to call the lords of fields lions, and those who till the fields mere cows, the answer, fitting the foolish saying, speaks rightly of *such* lords as having the brutal, rapacious, and carnivorous qualities of that keen-toothed, strong-clawed beast of prey. In the old days, when the fighting men who became lords of the land chose savage brutes for their knightly cognizances, savagery and brutality were not regarded as undesirable qualities; and probably most of these gallant ruffians, from my lion-hearted namesake downwards, deserved their titles as thoroughly as Chingachgook deserved to be called The Big Snake. But it is otherwise now; and poets, even poets laureate, might be better employed than in attributing to landowners the brutal qualities which of yore were essential—as the fate of all mild lords and princes showed—to the lengthy tenure of war-captured land. The fault is not amended by going outside that poor old heraldry to call our labourers "peasant cows."

THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

By Edward Clodd.

PART II.

Chapter III.—The Origin of Life-Forms.

MOISTURE as well as heat is essential to life; therefore life had its beginnings in water, but whether as plant or animal is a difficult question to answer. The fossil-yielding rocks tell us nothing about it, and the lowest and simplest plants and animals have so much in common that any attempt to gather evidence from them as to the priority of their respective ancestors must fail. But, however closely the earliest life-forms were related, there is fundamental difference to be drawn between their successors in the *mode of nutrition*, a difference which may throw some light upon this problem of priority, and which is not effaced by the existence of certain flesh-eating plants and vegetating animals, since this witnesses to the interchange of modifications of which protoplasm is capable.

The plant alone has the power to convert the elements of lifeless matter into the living solid state, thereby storing up energy for its own use in growth and germination, and for the use, directly or indirectly, of the animal. This the plant is enabled to do in virtue of its green colouring matter, called chlorophyll, which absorbs certain sun-rays, and sets up chemical action by which carbon is separated from oxygen in carbonic acid gas, and hydrogen from oxygen in water, forming hydro-carbons in which energy is stored up. Now if the animal is entirely dependent upon the plants for this energy, it would seem clear that they were the first to be developed.

Mr. Grant Allen has marshalled the arguments in support of their priority, drawn from the foregoing facts, in a paper of great force and clearness, which has apparently received but scant attention from biologists.* He submits that as the solar rays are, in the absence of chlorophyll, powerless to set up the separative action resulting in the material on which alone life can be sustained, the inference is obvious—no chlorophyll, no life. In other words, life being due to energy radiated from the sun, which energy is inoperative without chlorophyll, protoplasm *plus* chlorophyll is the physical basis of life.

Against this we have the opinion of authorities of the rank of Professors Ray Lankester among zoologists, and Thiselton Dyer among botanists, that the earliest protoplasm was destitute of chlorophyll. They contend that since chlorophyll is a modification of certain parts of the protoplasmic cells, it is not a thing of primary origin, but a later acquirement slowly attained. Both authorities incline to regard certain forms of fungi as representing "more closely than any other living forms the original ancestors of the whole organic world"† . . . "which existed before plants possessed chlorophyll at all."‡ But fungi, as Mr. Dyer admits, "draw their nutriment from compounds derived from other organisms, and therefore in a higher state of aggregation than those the green plants make use of, so far approaching animals in the mode of their nutrition." That is to say, fungoids are like animals; they use up the energy which the plants accumulate, and fill a secondary place in the succession of life-forms. The strength of Mr.

* *Gentleman's Magazine*, June 1885, "Genesis."

† *Encyclop. Brit.*, Art. "Protozoa, p. 832.

‡ *Ibid.*, "Biology," p. 691. Cf. also Professor Huxley's *Critique and Addresses*, p. 239.

Allen's position lies in this, that *viewing life as a product of Power operating under its separating action of Energy upon Matter*, an energy-storing organism must have come first. If the first protoplasm lacked chlorophyll, it had within it the possibilities which permitted its secretion at an early stage; it was, to use an unavoidably long word, chlorophyllaceous. The question, however, is of no serious importance in view of the common evolution of living things, and we may pass to less debatable ground in inquiry into the causes which have developed them in countless variety from specks of relatively formless protoplasm.

The cell is the structural starting-point of all life. It is a small body of sticky consistence, enclosing a nucleus, which is the result of the first visible approach of protoplasm to unlikeness of parts, and the chief centre of activity. Every cell arises by separation from a pre-existing cell, and every living organism is made up of one cell or of many cells. The single cell of which the lowest organisms are composed does everything appertaining to life: it feels, moves, feeds, and multiplies. In the complex or many-celled organisms these functions are divided among the cells, each of which is independent, but nevertheless adapts itself for the work it has to do. Division of labour causes difference of structure; stem, root, sap, leaf, and seed in the plant; bone, muscle, nerve-tissue, blood, and egg in the animal; all are communities of cells of astounding minuteness variously modified.

The one-celled forms increase by division. Growth is the balance of repair over waste, and when through assimilation of food into its substance the cell reaches a certain size, the force of cohesion is overcome by the release of the energy derived from food, and the cell divides equally at the kernel or nucleus. The slimy protoplasm distributes itself around each nucleus as the two part company, to grow and divide again in like manner *ad infinitum*. To these lowest Protozoa we may apply the words, "thou art the same, and thy years shall have no end," at least till all life here has end; for they were the Alpha, and may be the Omega, in the earth's life-history; neither is one before nor after the other, since there is no descent amongst them, but only lateral multiplication. In many Protozoa a small portion of the parent is detached, a process known as generation by budding; but this and other modes of whole or partial fission are classed together as reproduction by multiplication.

The next stage in structure is when the cells, in dividing, remain grouped together. In the plant, as has been shown already, the secretion of an envelope of cellulose round each cell, and the close union of the outer cells into a thick wall which gives stability to the structure and protection to the inner cells, causes the plant to lose touch, as it were, with the outer world, compared with the less rigid surface of the animal cells, which remained responsive in every part to stimuli from without.

The study of cell-division is profoundly interesting. The cells divide in definite order into two, then into four, then into eight, and so on, clustering together in a mulberry-like mass. Mutual pressure of the surface-cells against one another causes them to flatten into a membranous layer covering larger and denser cells. At a later stage these also spread out, the two layers forming the material out of which are developed the most complex animals. These layers, or cell-strata, which have been traced back to the first stage of division of the germ or egg, compose the double wall of the body of all animals above the Protozoa; but as we rise in the scale a third layer, larger and more complex, appears, from the subdivision of which the greater number of organs of the body, be it of a worm or a man, are developed. The upper layer gives rise to the skin, the nervous system, and organs of sense; the lower layer to the intestinal canal and appendages; and the middle layers to the general skeleton, the heart, and other important organs. The animal kingdom, treating it broadly, has therefore a threefold division—(1) simple forms, having no body cavity; (2) intermediate forms, having body cavity; (3) highest forms, having digestive cavity separate from body cavity. All have developed by slow and numberless modifications from the nucleus of a single cell, the higher passing through the grades of structure of the lower in their growth from the egg.

All plants and animals above the lowest are reproduced by the agency of special cells, the impregnation of the nucleus of the germ or egg-cell of the female by the nucleus of the sperm-cell of the male being necessary. There are numerous variations in the organs, but whatever unlikenesses exist in detail do not affect this general statement: alga and oak, sponge and man, are alike developed from germs variously called spores, sacs, seeds, and eggs. The structure of the egg of the parent determines the structure of the offspring, which, as will be shown in due course, reproduces the series of forms through which its ancestors passed as it progresses to its adult state. In other words, the individual, as it developes from the egg-cell, epitomises the history of its species.

The transmission of parental form and structure, as well as of mental character, to offspring, being clear, the question suggests itself—How have variations, resulting in millions of past and present species of plants and animals, arisen?

The ultimate causes of variations are extremely obscure, and possibly lie beyond human power to discover, but when we consider the mobility and minute complexity of structure of living things invisible to the naked eye, and their response to every shiver of energy from without, we have sufficing factors to produce unstableness which will result in unlikeness of parts. Given a body which, although a minute speck, contains billions of molecules performing complicated movements of immense rapidity, and sensitive in inconceivable degree to the play of vibrations impinging upon them at the rate of hundreds of trillions per second, would not the marvel be if these quivering particles of the structure, shaken by energies within, and by still more potent energies without, did not undergo continuous redistribution?

The position may be thus stated. The organism has—(1) Infinite complexity of structure; (2) Inherited tendencies; (3) Mobility and continuous motion, therefore tendency to vary; (4) Variations are induced by the surroundings on which, as vehicles of energy, life depends; (5) The surroundings change, and the organism adapts itself or not to the change; (6) Such as fail to do this perish; (7) Such as adapt themselves vary in greater or lesser degree; (8) These variations, being transmitted, are stages in the development of different life-forms. To put the matter briefly—likenesses are inherited, variations are acquired.

This brings us to the theory linked with Mr. Darwin's name, and which explains by what operation of natural causes the highest plants and animals have descended by true generation and slow modification from less complex life-forms, and these in ever-lessening degrees of complexity and unlikeness until the common starting-point from the lowest or one-celled organism is reached.

Following Lyell's method of explaining the past by agencies still in working, and adapting hints from Malthus and other writers in the clearing up of questions suggested by observations extending over many years, Darwin propounded a theory which, in the judgment of every biologist unfettered by predilections or prejudices, accounts in large degree for the origin of species.

PHOTOGRAPHS OF DOUBLE STARS AND STAR CLUSTERS.*

By MM. Henry.

We have obtained a certain number of good photographs of double stars and star clusters, by regulating the duration of the exposure according to the photographic intensity of the components. The magnitudes of the discs of stars as photographed in our charts of the Pleiades and of [a portion of] the Swan (see Knowledge for May and June, pp. 213, 243), which might have led to the idea that very close pairs could not be recorded photographically, were due to the long exposure necessary for stars of the lowest magnitudes; the discs grow larger with the exposure, but always begin by a minute point. A star of the first magnitude which has been on the plate but the two-hundredth part of a second, shows only a point, not a large disc. It is the same with a star of the second magnitude which has not been photographed for more than the time (0·013 sec.) necessary for recording it, and so forth. It has been found that the durations of exposure for the different orders of star magnitude are as presented in the following table:—

	Seconds.		Seconds.
1st magnitude . .	0·005	6th magnitude . .	0·5
2nd ,, . .	0·013	7th ,, . .	1·3
3rd ,, . .	0·03	8th ,, . .	3
4th ,, . .	0·08	9th ,, . .	8
5th ,, . .	0·2	10th ,, . .	20
&c.,	&c.,	&c.	

Fig. 1.—Photograph of the Great Cluster in Gemini. (35 Messier.)

If the exposures are not exaggerated, as they must be to obtain on the same plate stars included between the 1st or 2nd magnitude and the 16th, the stars only record themselves as minute points, and thus close doubles are self-recorded (*s'enrégistrent d'eux-mêmes*).

* From *L'Astronomie.*

Among the star clusters of which we have obtained satisfactory photographs, we present here the cluster in Gemini (Messier 35),* that magnificent cluster, 19′ in diameter, composed of stars from the eighth to the fourteenth magnitudes, whose arrangement has struck all observers. We find here an astonishing stellar wealth which charting can only reproduce laboriously and incompletely; but photography reproduces it faithfully (fig. 1).

Fig. 2.—Photograph of Vega and its Companions.

Let us note also in the same class of work, the group of the small companions of Vega (fig. 2), and the group of the fine quadruple star ε Lyræ (fig. 3). The magnitudes in the former group are from the 1st to the 16th; for the latter from the 5th to the 15th. In the latter group, irradiation resulting from the length of the exposure necessary to show the very faint stars has combined the two discs of each pair into one, in such sort that we have two monstrous discs instead of two neat pairs. But as will presently be shown, these double stars have been photographed separately with a very short exposure (a quarter of a second).

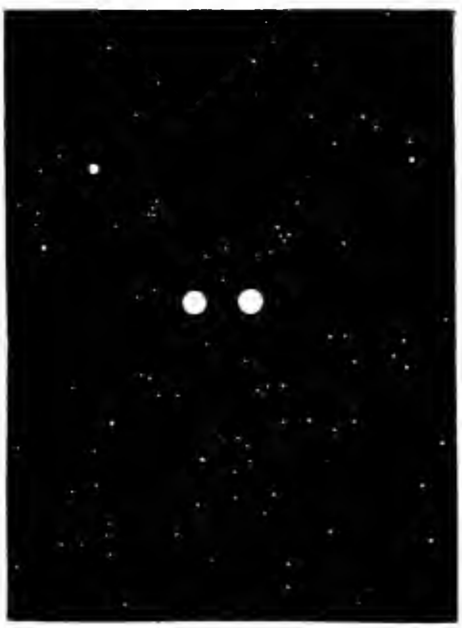


Fig. 3.—Photograph of the Group Epsilon Lyræ.

* It lies within the limits of the Milky Way, just north of the ecliptic and east of the solstitial colure.

Among the double stars which we have photographed and measured (in 1886), we may cite:—

	Magnitudes.	Distance.	Position-angle.
61 Cygni	5·5 and 6	20″·48	119°·7
ζ Ursæ Majoris	2 5 and 4	14·37	149·1
π Bootis	5 and 6	5·87	102·6
γ Virginis	3·0 and 3·2	5·34	333·2
44 Bootis	5·3 and 6	4·86	239·4
α Herculis	3·5 and 5·5	4·73	116·1
ρ Herculis	4·0 and 5·1	3·71	311·3
δ Serpentis	4 and 5	3·45	118·7
ε¹ Lyræ	6 and 7	3 06	14·3
ε² Lyræ	5·7 and 6	2·34	136·7

These direct photographs enable us to measure on the plate itself the position-angle of the components as well as the distance. To determine the angle of position, we first, as in direct observation, allow the pair to advance in the direction of the diurnal motion, photographing itself a certain number of times along its line of motion. We thus obtain a result such as is shown in fig. 4. This line of motion is, of course, an east-and-west line, self-recorded with precision. Consequently, starting from this line, we measure the position angle on the plate itself.

Fig. 4.—Path of the Double Star Mizar on the Photographic Plate.
Exposure such as to show the smaller star, and therefore to present the larger as a disc.

In the case cited the star photographed is Mizar; the north (0°) is below, the east (90°) to the right, and the angle of position is 149°·1.

Fig. 5.—Paths of the Double Stars κ Bootis, 58 Corvi, and γ Virginis.
Exposures varying according to the conditions.

[Fig. 5 shows the pairs κ Bootis, 58 Corvi, and γ Virginis. It will be noticed that although κ Bootis is only a fourth-magnitude star, and 58 Corvi below naked-eye vision, while γ Virginis is a third-magnitude star, these differences are not recorded in the photographs, the exposure necessary for obtaining photographic records being different in these different cases. The double stars which lend themselves best to the photographic method are those whose components are nearly equal.]

Messrs. Henry describe and picture an instrument for magnifying and measuring the photographs of double stars, "a sort of stellar microscope, which gives the distances of double stars to the hundredth part of a second, by a process akin to micrometric work. Astronomers and men of science interested in the study of double stars and stellar systems will no doubt be glad to learn," they add, "that photography may hereafter be applied effectively in these important researches."

MINUTE MEASUREMENT.

NO one in the least degree familiar with science in its historical aspect can be ignorant of the extent to which it has been indebted for its enormous advancement to the increased and increasing delicacy of physical measurements. Nor is this merely true in connection with any single branch of natural knowledge. Whether (taking a very few illustrations almost at random) we select the instruments employed by Tycho Brahé, for comparison with those now to be found in every first-class observatory in the world; the rude balances of the alchemists with the exquisite masterpieces of Oertling; the rough means of mechanical measurement employed by Galileo, with the fittings of a modern physical laboratory; or the screws cut by Plumier at the beginning of the last century with the mechanical marvels turned out by Sir Joseph Whitworth, we shall alike be struck with the manner in which our knowledge of those branches of science in whose pursuit they are respectively employed have advanced *pari passu* with the improvements in them. It may then be neither uninteresting nor uninstructive if we attempt to give, in a popular form, some account of the manner in which ordinarily insensible quantities are made manifest and easily measurable; and to this end we propose to describe in a familiar style some of the devices and instruments employed in the measurement of extremely minute quantities. Such description may enable those who have previously devoted but scant attention to the subject to realise with more force the trustworthiness of the data on which scientific theories are now founded, and to appreciate better the confidence with which modern men of science regard their results.

Suppose, then, in the outset, that we wish to measure a distance to the one-hundredth of an inch upon a given straight line, in what way shall we proceed to do so? Scarcely by dividing a straight scale so finely, and using that as our standard; inasmuch as the strokes of the divisions, and the intervals separating them would probably differ too little in width to be trustworthy by ordinary vision. Perhaps one-fiftieth of an inch is the smallest quantity which can be fairly employed for such a purpose by a person of average sight, and one half of this *may* be estimated. If, though, we are merely to employ estimation, a very little practice will enable us to take off quantities of this order of minuteness with considerable accuracy from a scale divided into inches and tenths, as in fig. 1,

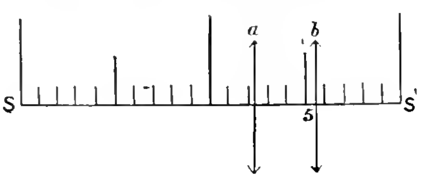


Fig. 1.

where s s′ represents a scale so divided. If now we require to take off $1\frac{1}{2}$ inch from this scale, we, of course, simply place one point of our compasses on s and the other on 5 in the figure to get what we want at once. If, though, we wish to obtain a length of, say 1·22 inch, then again placing one point of our compasses on s, we extend the other to *a*, as nearly as we can estimate 0·2 division beyond the second division of our second inch, and thus we obtain the length required. In a similar way it will be seen that the distance between s and b=1·56 inch, and so on. But, after all, guessing to a certain extent enters into such determinations, and men of science cannot in the least degree afford to be dependent on guesswork. Let us, then, see whether we can find any more rigidly accurate method of measuring a quantity so small as that of which we have been speaking. We do find such a one in what is called the "Diagonal Scale," which is engraved on the boxwood or ivory protractor in every case of mathematical instruments—a scale which will not only enable us to measure to the one-hundredth of an inch, but to the one-hundredth of even a quarter of an inch (or the four-hundredth of an inch) if necessary. The principle on which it is constructed will be evident from a little study of fig. 2.

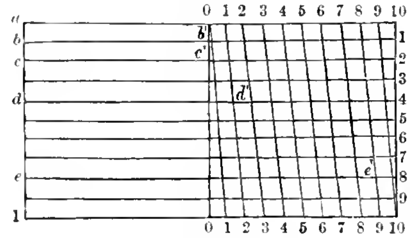


Fig. 2.

Here we see eleven equidistant parallel lines, the upper one of which is divided into two of the primary units (inches) in our figure, and perpendicular lines drawn through them. In practice, of course, the scale shown above would be extended towards the left and divided into inches, as in the case of *a* 1 *o o*. It is, however, with the right-hand one of these primary divisions that we are here more particularly concerned. This we subdivide into ten equal parts, both upon the upper and lower lines. We now draw straight lines from the zero point above to subdivision 1 below, from 1 above to 2 below, and so on, until we come to subdivision 9 above, which is joined to 10 below. Then obviously, as all these diagonal lines are parallel and equidistant at every point, while the first one coincides with the zero point at *o* on the top line, it must depart one-tenth of a subdivision from the perpendicular *o o* in the second, two-tenths in the third, three-tenths in the fourth . . . and so on to ten-tenths, or one entire subdivision on the bottom line. Then evidently $a\,o = 1$ inch and *a* 1 (still measuring on the top line) 1·1 inch; $b\,b'$, however, as will be easily seen, = 1 inch + one-tenth of one-tenth of an inch, or ·01 inch; in other words, $b\,b'$ = 1·01 inch. Similarly, $c\,c'$ = 1·02 inch. So again, $d\,d'$ = 1 inch + ·2 inch + ·04 inch—*i.e.* to 1·24 inch; as does $e\,e'$ to 1·88 inch, and so on. For clearness, we have drawn our figure to a one-inch scale, but on the ivory protractors in cases of instruments a quarter of an inch scale will be found to be divided in this way: from which, as we have said above, $\frac{1}{400}$th of an inch should, theoretically, be susceptible of measurement. Perhaps half this quantity, though, is all that can be rigidly depended on with ordinary compasses. But in describing the construction and use of the diagonal scale, we have presupposed the employment of compasses, or something analogous, to take off the quantity we require; and it must be obvious, on the slightest reflection, that no such mode of proceeding is, or can be, applicable in such cases as those of the measurement of the height of the mercury in a barometer, or angular deviation on the "limb," or circular periphery, of a circle employed to measure angles with. It is true that a diagonal scale was engraved on the limbs of astronomical quadrants by Cantzler in England towards the end of the sixteenth century, and was adopted by Tycho Brahé; in which case, the sharp straight edge of the observing arm, or a hair coinciding with a radius of the quadrant, cut the diagonal scale. Reference to fig. 2 (p. 78), though, will show that while absolutely true as a means of subdividing a straight measure of length, diagonal lines only afford an approximate measure of a circular arc, although this approximation was sufficiently near for the purpose of astronomers in Tycho's day. It is, however, to a certain Captain Vernier that we are indebted for a method of subdividing graduation both on straight and curved lines, remarkable at once for its elegance and accuracy. His device, now universally known as a "Vernier," must be familiar to every one who has ever seen an upright barometer or a sextant. It was originally described by him in a tract published in Brussels in 1631. The principle on which it is based may be gathered from a study of fig. 3, which represents it as applied to a common barometer.

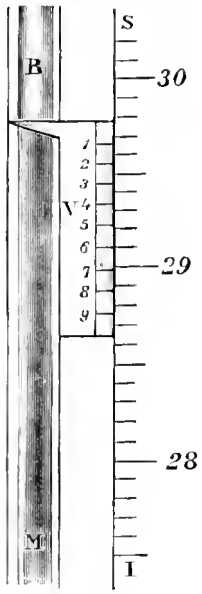


Fig. 3.

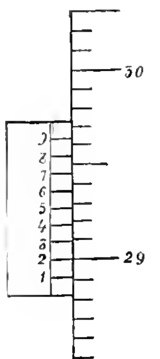


Fig. 4.

In the figure above, S I is the scale of inches and tenths engraved on the right-hand side of the mercury tube, B M. It really starts from the surface of the quicksilver in the cistern; but as the mercury never falls much below 28 inches at the sea-level, the scale begins somewhere about there, and, as it stands, shows the height of the mercury in inches and tenths. In order, then, to measure the tenths of these tenths, or the hundredths of an inch, the vernier is employed, as shown above. In this its original form it consists of a little scale, V, measuring exactly one inch and one-tenth, but itself divided into only 10 equal parts. Now as these 10 divisions on the vernier equal to 11 on the scale of inches, it is obvious at a glance that each division of the vernier must be equal to $1\frac{1}{10}$th division of the inch scale—i.e. to $\frac{11}{100}$ths (0·11) inch. Suppose, then, that the top line on the vernier accurately coincides with any given one on the inch scale, then will that immediately below it differ $\frac{1}{100}$th of an inch from the next division on the inch scale, the second beneath it $\frac{2}{100}$ths inch from the corresponding division, and so on. Looking, then, at our figure, we see that the line marked 6 on the vernier coincides with that corresponding to 29·1 inches. Hence that marked 5 must be ·01 inch above its corresponding line, line 4 ·02, line 3 ·03, line 2 ·04, line 1 ·05, and the top of the vernier ·06 of a division above the line over which it stands. This, however, we see is 29·7, and hence the barometer reads 29·76 inches. This, as we have said, was the form of the vernier as originally devised and described by its inventor; but it will be noted that, whereas the inches and tenths of the primary scale read upwards, in this construction the hundredths are read downwards. Let us see if it be not possible to obviate the slight confusion which might arise from this, and make both scale and vernier read in the same direction. The method of doing so is extremely simple, and is illustrated in fig. 4.

Instead of dividing 11 of the primary divisions in 10 equal parts, we here take 9 of those primary parts for such divisions; so that, in the case of any two lines being coincident, the vernier line above falls short of the corresponding one on the inch scale by ·01 inch, and so on. Evidently in this case the divisions of the vernier will read upwards the same as those on the primary scale. Our figure represents the instrument as reading 29·72. In astronomical and surveying instruments and the like, the vernier thus reads forwards, though in all cases in which extreme delicacy of measurement is necessary, the vernier itself in such instruments has been superseded by the micrometer microscope, to be referred to further on. Reverting for a moment to the barometer: in all standard instruments 24 of the primary divisions, each equal to $\frac{1}{20}$th of an inch, are taken as the length of the scale of the vernier, which is divided into 25 equal parts. Hence each of these falls short of a fixed division by $\frac{1}{25}$th of $\frac{1}{20}$th or $\frac{1}{500}$th of an inch, and as this is halved in the case of the apparent coincidence of two adjacent pairs of lines, the height of the mercury is read in such instruments to the $\frac{1}{1000}$th (·001) of an inch.

After our description of the vernier, as applied to the subdivision of a straight scale, little need be added as to its application to the circular graduated "limb" of an instrument. In those mostly in popular use, such as the theodolite, sextant, and the like, the graduation on the primary arc or circle is to 30′, 20′, or 10′; then, by the aid of the vernier, these would be subdivided to 1′, 20″, or 10″ respectively. For example, if the circle is divided to 30′, then taking 29′ as the whole length of the vernier, and dividing this into 30 equal parts, in the case of two coincident lines the pair next beyond them will be separated by $\frac{1}{30}$th or 1′, the pair above that again by $\frac{2}{30}$th or 2′, and so on; and so the scale can be read to a single minute. It may serve to show how enormous is the gain from the use of the vernier in such a case if we mention that the ordinary pocket sextant, with a radius of less than 1·7 inch, is thus read to minutes: whereas if we divided a circle itself to this degree of angular minuteness and made each minute =·02 inch (smaller divisions would in such case be useless), the circle itself would have to be some $11\frac{1}{2}$ feet in diameter! If the arc were divided into 10′, then taking 59 of such primary divisions (=9°·50′ in the limb) for the total length of our vernier, and subdividing this into 60 equal parts, it will be evident that the 60th part of 10′, *i.e.* 10″, may thus be read off. Six-inch sextants are now so divided.

We cannot take leave of the vernier without inviting attention to a blunder which has been copied from book to book for the last hundred years. Sometimes it takes the form of the expression "the Nonius or Vernier," at others (as on p. 766 of Chambers's, usually marvellously accurate, "Descriptive Astronomy") we find Nonius described as the inventor of the vernier. He was nothing whatever of the sort, the "Nonius" and the "Vernier" differing wholly in principle. The attentive reader has, it is to be hoped, by this time thoroughly grasped the idea underlying the construction of the vernier. The graduation suggested by Nonius was this:—Forty-five concentric circles were to be described upon the limb of the instrument and divided into four quadrants by diameters intersecting at right angles, then the outside quadrant was to be divided into 90 equal parts, the next into 89, the third into 88, and so to the inside one, which was to be divided into 46 equal parts. The number of each of the subdivisions was marked against its corresponding quadrant in the instrument. Now one edge of the bar carrying the sight vanes passed, when produced, through the common centre of all the circles, and Nonius supposed would cut *some* division on one of the circles accurately; then the angle corresponding to this division is calculated from the number of the divisions intercepted and the entire number in the quadrant of which the coincidence occurs. Thus, suppose that the edge were found to coincide with division 31 of the quadrant divided into 72 parts, then the arc in degrees is $\frac{31}{72}$ of 90° or 38° 45′, and so with any other circle. This device, however, never came into general use, for Tycho Brahé adopted it only soon to abandon it for the diagonal scale (of his use of which we have spoken before), and it comparatively soon died a natural death.

(*To be continued.*)

THE NATURALIST'S LABORATORY.

CONTRIBUTION VI.

LABORATORY FURNITURE—(*continued*).

CHAIRS AND TABLES.—Simplicity of design is here to be observed as a *sine quâ non.* The chairs used at the working table should be armless, of the variety generally adopted for bedrooms, or the so-called "Windsors" of the kitchen; but for comfort, elegance, and portability the Bohemian bent-wood chairs, with polished perforated wooden seats, are to be preferred before cane-bottomed or solid wooden seats. Upholstered furniture of any sort should not be permitted to enter the room, as such articles not only afford a clinging-place for dust and dirt, but are in themselves small factories of those undesirable entities. A single armed chair, however, of the kind known as the circular "office-chair," made entirely of French-polished ash or oak wood, may be placed by the side of an *escritoire.*

Of tables, four patterns may be introduced with advantage:—(α) *The Dissecting Table*—to be placed in proximity to the sink and water-supply—ought to be made of well-seasoned wood, and very firmly built. The top of the table should be about three feet above the floor, *i.e.* six or eight inches higher than an ordinary writing table. This will enable the anatomist to operate more freely whilst standing, as it will be found that much of this kind of work can be more efficiently and comfortably accomplished in that posture; but provision should additionally be made to enable the dissector to be seated, and a stool on the trivet principle, without back or arms, will be found to meet his wants most admirably.

The biologist's dissecting table shown at fig. 1 has been devised to meet the requirements of the naturalist's laboratory, private or public. It is intended as a working table for one person, but, of course, by increased dimensions the article may be modified so as to accommodate more than one worker at a time.

The black line *l* (fig. 1), over the top of the table, represents a sheet of lead or zinc, guttered crosswise across its surface, *g. g. g.*, which carry blood, washings, &c., into basin B. A longitudinal gutter, which crosses the three gutters above mentioned midway, is of course not shown in the diagram; T shows the table-top, affording a small border of wood, two inches wide, around the metal. This device allows for the attachment of dissecting hooks, connected to the subject by means of slender chains, whereby the fascia, &c., may be turned and held aside to enable the operator to work with greater ease upon any desired part. The basin B can be made to discharge into a pipe leading to a trapped sewer-gully, such as the famous "Kensington trap" of Messrs. James Stiff & Co., of Lambeth, or its contents may simply be received into a pail or bucket placed immediately beneath the orifice of discharge under the table, to be removed from time to time as occasion may require. Whilst dissecting the student will find it advantageous to keep the basin full of warm water, with a soft sponge or two at hand, wherewith to sop up extraneous humours; a plug is therefore provided at the bottom of the basin. One of the most important novelties, however, in this table is the drawer, *d*, which is fitted with a hinged board, *b*, as shown in the figure; when the drawer is pulled out the board may be made to assume the position *b′*, and

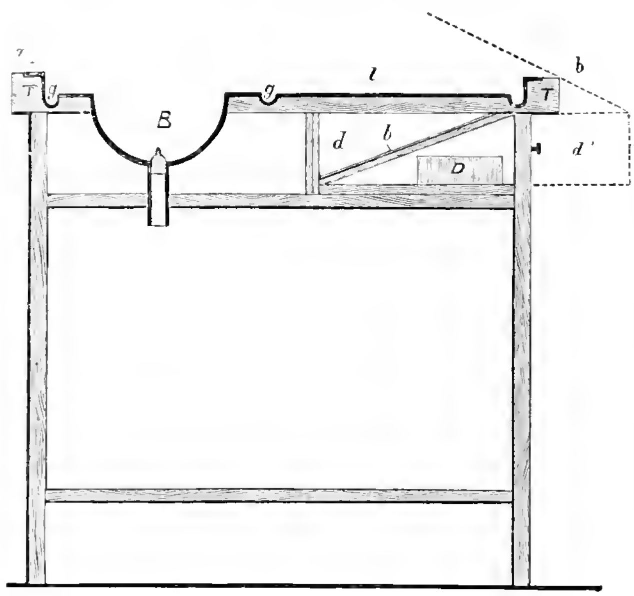


FIG. 1.—BIOLOGIST'S DISSECTING TABLE.

thus affords an extempore desk, which can be inclined at any angle to suit the convenience of the worker. It would be well to have this board fitted with a superficial pad of drawing-paper, upon which rough sketches, diagrams, and notes can be readily made of the dissection from time to time, and thus afford a lasting record of what may prove to be of considerable importance when the student comes to project a detailed description of his researches. The want of this item is a source of great annoyance to the anatomist, who often finds that his memory is apt to prove deceptive, or that his notes on scraps of paper are insufficient or mislaid when wanted; it does, in fact, supply that businesslike methodicity which reaps its own reward, alike in science as in commerce. When the drawer is closed, and the drawing-board turned down within its recess, as shown at fig. 1, *b*, it will be observed that ample space is left below it for the storage of notes and drawings taken, and for a case or two of dissecting instruments, D, boxes of pencils, ink, &c. A table thus constructed will be found most convenient for amateurs, private laboratories, and such colleges as provide separate benches for each student: it is a vast improvement on those in common use either in this country or on the Continent. The surface of the table-top should measure about 3 feet 6 inches by 2 feet. The diameter of the basin ought not to exceed 10 inches.

(β) *The Microscopist's Working Table.*—As a very large part of the naturalist's work nowadays calls into use that most useful of modern inventions, the compound microscope, a special table designed to facilitate research must here be looked upon as something indispensable. The objects of the design, now submitted to the notice of students of nature for the first time, are to afford general convenience during study, and to enable one to record observations graphically on the spot. To accomplish these the table is divided into two parts—the microscopist's, M (fig. 2, A and B), and the artist's portion, D (fig. 2, A and B). The dimensions of the table are clearly indicated

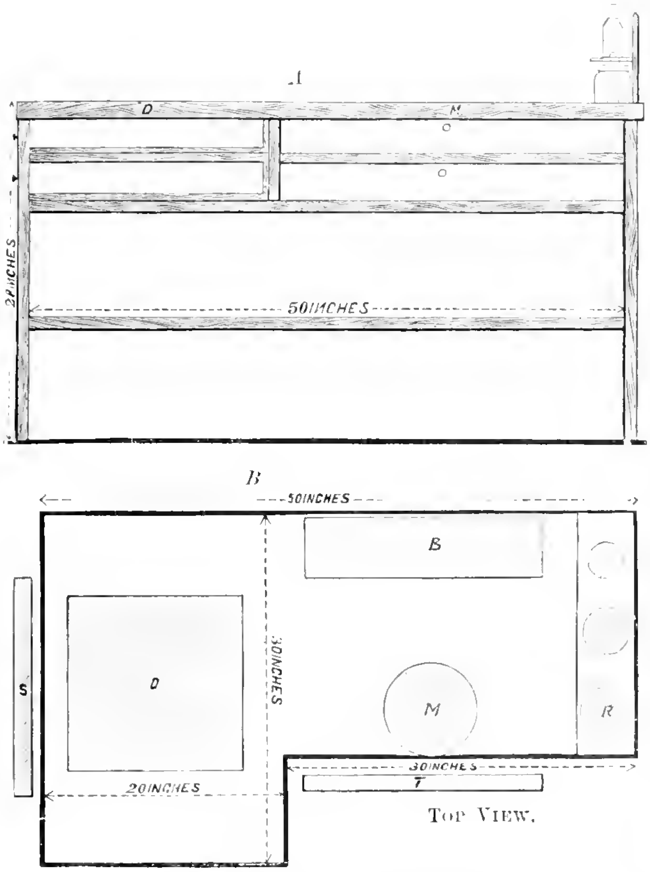


FIG. 2.—MICROSCOPIST'S WORKING TABLE.
A, Side Elevation. *B*, Top Plan.

on the figures. A, fig. 2, is a working plan to show the end elevation of the structure; B gives a good idea of the shape of the table-top. Each part is furnished with two drawers as shown at A; the drawers under D afford space for the storage of colour-boxes, pencils, paper, &c., those beneath M are intended to receive microscopical accessories, such as glass slips, instruments, live boxes, troughs, and the hundred-and-one odds and ends that may be required from time to time by the worker in Nature's unseen universe.

The longest end of the table, viz., that parallel with B, fig. 2, B, ought to face a window approximately looking northwards. The worker, seated on the bench T, fig. 2. B, can thus employ direct or reflected light according to the position, inclined, upright or horizontal, in which he places his microscope. To his right there is fixed a reagent stand, R, fig. 2, A and B. As soon as he has completed his observations, or adjusted an object which he deems worthy of delineation, he should shift his instrument to the position D, fig. 2, B, and take his seat upon the chair S, fig. 2, B. By so doing, he will gain the inestimable advantage of working in a clear transmitted light without the chance of a vitiated result through interference rays, and with absolute security against the evil effects of a more or less intense glare. The value of thus being able to shift one's position from front to side on the table will soon become evident to workers with the microscope who indulge in prolonged observations. The top plan, fig. 2, B, shows the position of the microscope during investigation, or whilst mounting objects; B, place for a dust-proof box, for use whilst preparing specimens for observation, a detailed description of which will be given in the sequel; D, the position of the microscope when used with the camera lucida for delineating objects, or when employed with the polariscope, or where pure transmitted light is alone admissible; R, the reagent stand.

(γ) *The Occasional Table.*—A round-topped table, preferably with a slate top, about 2 feet in diameter, and iron stand, is a very useful adjunct to the naturalist's laboratory. Placed by the window it affords a convenient place for overhauling and sorting the captures of a day's pond-hunt or country ramble, for noticing the life-habits of minute organisms, and for general displays. Such tables may be purchased from any dealer in microscopical apparatus, and may be seen in full working order in the laboratory of the well-known microscopist, Mr. Thomas Bolton, of Birmingham.

(δ) *The Writing Table.*—There can be no doubt that of all forms the so-called library table is the most useful here. Its large flat surface gives room for the artist to exercise his ability in making large drawings or diagrams wherewith to illustrate lectures or papers; there is also plenty of space for the current journals, in addition to elbow-room for the author. Library tables may be purchased in all sizes, to suit the dimensions of the student's apartment, from most respectable furniture dealers.

In our next contribution we shall conclude this subject, with detailed descriptions of various articles necessary to the equipment of a perfect laboratory, inclusive of such apparatus as do not strictly come under the heading of instruments for research.

THE WHIST SUPERSTITION DISPELLED.*

By "FIVE OF CLUBS."

IF anyone were asked how often he held a singleton he would probably answer, "In one hand out of *twenty*," or some such high number. The real proportion is one in little more than *three*. Anyone who cares to note as an evening at whist proceeds, and evening after evening for a considerable time, the number of singletons he holds, or that others in the company hold, he will find that this is about the proportion shown in the long run.

The proof is not simple, because a singleton can appear in many different ways, and each requires a separate calculation. But those who possess our little treatise, "How to Play Whist," will find under the head "Whist Whittlings," in pages 194 to 197, the necessary details for the calculation; or they may take the results there collected as already calculated. The table at p. 196 shows the chance of every possible arrangement of suits in a hand, from the most frequent case—4 of each of two suits, 3 of a third, and 2 of the fourth—to the case of 13 cards of one suit. The table further shows, by the way, the chances for every possible arrangement of the 13 cards of a suit in the four hands, from the most frequent case—4 cards of the suit falling in each of two hands, 3 in a third, and 2 in the fourth—to the case of all 13 cards falling into one hand.

Now, collecting from this table at p. 196 of "How to Play Whist" all possible arrangements of the suits in a hand by

* See last number of KNOWLEDGE, p. 57.

which at least one singleton shall appear in the hand, we form the following little sum in addition :—

Arrangement.	One-fourth of the number of hands in which arrangement can appear.
5 ; 4 ; 3 ; 1.	20,527,933,140
6 ; 4 ; 2 ; 1.	7,464,702,960
6 : 3 ; 3 ; 1.	5,474,115,504
5 : 5 : 2 ; 1.	5,038,674,498
4 ; 4 : 4 ; 1.	4,751,836,375
7 ; 3 ; 2 ; 1.	2,985,881,184
6 ; 5 ; 1 ; 1.	1,119,705,444
7 ; 4 ; 1 ; 1.	622,058,580
8 ; 2 ; 2 : 1.	305,374,212
8 ; 3 ; 1 ; 1.	186,617,574
7 ; 5 ; 1 ; 0.	172,262,376
6 ; 6 ; 1 ; 0.	114,841,584
8 ; 4 ; 1 ; 0.	71,775,990
9 ; 2 ; 1 ; 1.	28,275,390
9 ; 3 ; 1 ; 0.	15,950,220
10 ; 2 ; 1 ; 0.	1,740,024
10 ; 1 ; 1 ; 1.	628,342
11 ; 1 ; 1 ; 0.	39,546
12 ; 1 ; 0 ; 0.	507
Total . . .	48,882,413,450
	Multiply by 4
Grand Total . .	195,529,653,800

That is to say, there are 195,529,653,800 possible hands at whist, in which one singleton at least appears.

Now the total number of hands *possible* is no less than 635,013,559,600. Thus the chance of a hand showing one singleton at least is represented by a fraction of which this number is the denominator, and 195,529,653,800 the numerator, and such a fraction is not much less than a third. Reducing the fraction by division (by 200) we see that it may be very nearly represented by

$$\frac{97765}{317507},$$

and on applying to this the method of continued fractions we get

$$\frac{1}{3+}\ \frac{1}{4+}\ \frac{1}{26+},\ \&c.,$$

showing that the fraction is very nearly represented by $\frac{4}{13}$.

Thus each player may expect to have a singleton in his hand four times in every thirteen deals. And he may expect to find a singleton in a plain suit three times in every thirteen deals.

Now obviously we must not multiply $\frac{4}{13}$ by 4 to get the chance that in one hand of the four a singleton will appear, for that would give $\frac{16}{13}$, or *more than certainty*, for such a result, which is absurd on the face of it. The proper way to calculate the chance for four hands is as follows :—

The chance that we do not find a singleton in the first hand we examine is $\frac{9}{13}$, and the same with the second hand, the third, and the fourth ; hence the chance that we do not find a singleton in any one of the four is represented (approximately) by

$$\frac{9}{13}\times\frac{9}{13}\times\frac{9}{13}\times\frac{9}{13}=\frac{6561}{28561}$$

(the last three digits of numerator and denominator being alike is an odd coincidence). Hence the chance that there will be a singleton in some hand is equal to

$$\frac{22000}{28561},$$

and the odds *in favour* of a singleton (one at least) appearing, are no less than 22,000 to 6,561, or about 7 to 2. These are not the correct odds, however, for four hands resulting from a single deal, because such hands are not independent of each other. If one hand of four dealt has the suits unequally divided, the chances are that there will be considerable irregularity in the others. The full treatment of the problem would require more work than the matter is worth. But from an approximative method I find the odds about 5 to 2 in favour of a singleton appearing in one hand at least of the four resulting from a deal. Hence, while the "nine times out of ten" mentioned in Bohn's "Handbook of Games" must be regarded as absurd, the wager offered by G. B.'s friend was short of the just odds, which are much in favour of a singleton showing somewhere. Yet no one who had not either calculated the odds for a singleton in a given hand (and thence inferred the probability of one singleton at least in four hands dealt) or observed the actual occurrence of singleton hands in a long series of deals, would think they occur so often. I suspect the cause may partly be that, while the player is apt to rejoice at the occurrence of a singleton in a plain suit (not, of course, that he would have any idea of such an iniquity as leading it), he is sure to be disgusted in much greater degree when he finds but a single trump in his hand. His pleasure in the first case, which occurs thrice as often as the other, being neutralised by his triple disgust at a singleton in trumps, the general effect is to greatly diminish the impression which a singleton, regarded *per se*, and independently of its being plain or a trump, would otherwise produce. In like manner the annoyance arising from the recognition of a singleton in an opponent's hand is neutralised by the lively satisfaction arising from the discovery that he has only one trump. The explanation may be far-fetched, but the fact to be explained is curious : it is certain that in about five deals out of seven, on the average, a singleton appears in one hand at least out of the four : it is equally certain that not one whist-player in a thousand would believe this till he had tested the matter statistically.

CONCISE EXPRESSION IN SCIENCE.

By W. Cave Thomas.

IS it not time that Scientists should express themselves more concisely than they are wont on the theory of light? To speak either of the "velocity of light" or "of light waves which have *travelled across* the illimitable depths of interstellar space," would have been perfectly correct under the Newtonian doctrine, but is incorrect, inapplicable, and misleading when applied to the "undulatory." In the first place, the theory of vibratory action in an ethereal medium teaches us that there is no *matter of light* to travel, and in the second that waves themselves do not *travel across* space, either limited or illimitable. The vibratory action initiated either by the sun or by the stars is *communicated*, telegraphed, through space, just as a wave excited at one end of a stretched cord is communicated throughout its length to the other; nevertheless, the initial wave does not *travel* the length of the cord. The inexact language I am alluding to in past and present dissertations upon the theory of light makes a thorough muddle of the Newtonian and undulatory hypotheses. Moreover, there is very much involved in the correct and clear apprehension of the facts we have cited. For if the vibrations that act upon the optic sense, and cause all the various sensations of light, are also those that act upon a sensitised plate, then we can no longer entertain the notion of a something *plus* a vibration, termed actinic force, being associated with a ray of light. Therefore, whatever special virtues may belong to that class of rays called the "chemical," those special virtues must consist in the mechanical action of the waves of this class upon certain substances.

[I sympathise much with Mr. Thomas's purpose in the above communication. But I fear that the strict accuracy for which he stickles can hardly be secured in company with great conciseness. Let anyone try to express concisely the idea conveyed, though not with strictly verbal accuracy, by—for example—the statement that the light of such and such a star took ten years to travel across interstellar space to the earth.—R. P.]

OUR PUZZLES.

SOME correspondents complain that we give too much room to puzzles, and they are too difficult. Our puzzles have mostly been intended as mathematical recreations. Here are three which are very easy—perhaps familiar to most readers—but interesting as studies.

PUZZLE XIX. *Show how to cut a regular tetahedron (equilateral triangular pyramid) so that the face cut shall be a square: also show how to plug a square hole with a tetahedron.*

PUZZLE XX. *Show how to cut a cube so that the cut face shall be a regular hexagon: also show how to plug a hexagonal hole with a cube.*

PUZZLE XXI. *Show how to cut a regular octahedron (a double square pyramid with triangular faces) so that the cut face shall be a regular hexagon; and show how to plug a hexagonal hole with an octahedron.*

The dodecahedron and icosahedron can be cut with decagonal faces or used to fill decagonal holes. The former also served the editor as a basis for his library and school star atlases, and for the equal-surface atlas whose maps are now in progress.

SOLUTION OF LAST MONTH'S PUZZLES.

PUZZLE XVI. Box No. 1 is 11 inches square, inside measurement, in the base; and $11\frac{9}{10}$ inches deep; and the fruiterer desires to pack in it 200 oranges.

He can effect this by the arrangement illustrated in fig. 1, *a*, where the 25 darker circles represent the lowest layer of oranges, and the 25 light circles the layer next above it, the successive layers corresponding alternately with these, so that the dark circles may be regarded as showing the positions of the oranges in the 1st, 3rd, 5th, and 7th layers, the light circles representing the positions in the 2nd, 4th, 6th, and 8th.

To determine the height of the centres in any layer above those in the next lower layer, let a plane be supposed taken through the centres of the oranges *a*, *b* in the lowest layer and *c* in the layer above. (This plane will be vertical if the layers are horizontal.) Then we have the section shown in fig. 1, *b*, where the centres *a*, *b*, *c* are represented by A, B, C. Since AC=CB=2 inches, CM$=\sqrt{2}=1\cdot414$ inch. Thus each layer rises 1·414 inch above the last; and since the lowest layer rises 2 inches above the bottom of the box, leaving $9\frac{9}{10}$ inches to the top, we are limited to as many layers above the bottom one as the (whole) number of times 1·414 inch is contained in $9\frac{9}{10}$ inches; i.e. there are 7 layers above the lowest (since $1\cdot414\times7=9\cdot898$). Thus there can be 8 layers, and it needs no proof that there can be 25 in each layer, arranged as in the figure. Consequently 200 oranges can be packed in this way. It will be shown

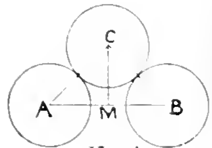


Fig. 1 b

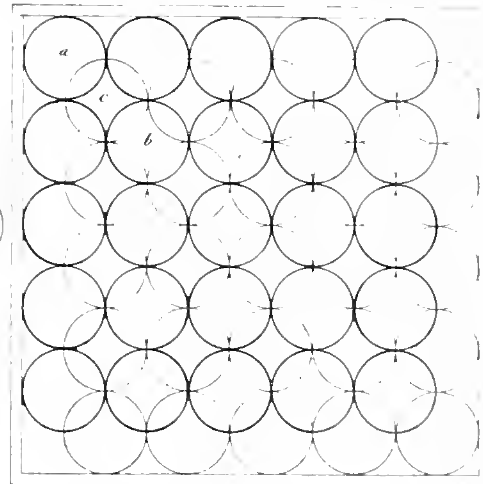


Fig. 1. a

presently that by no other arrangement can more than 200 oranges be packed in Box No. 1.

PUZZLE XVII. Box No. 2 has a base 12 inches by $11\frac{1}{4}$ inches, inside measurement, and is $11\frac{7}{10}$ inches deep. The fruiterer has to pack in it 231 oranges.

He can effect this by the arrangement shown in fig. 2, *a*, where the dark and light circles are to be understood as before. We get in 6 and 5 in alternate rows, and 6 rows fall easily within the $11\frac{1}{4}$ inches in the lowest row, for we see from fig. 2, *b*, that *b* and *c*, the centres of the 2nd row, fall further from the side of the box than *a* does, by the distance AM$=\sqrt{3}$, or 1·73 inch. Hence, since the 1st row reaches 2 inches from the side, the sixth reaches $2+5\times1\cdot73=10\cdot65$. But it is further manifest that *e*, the centre of an

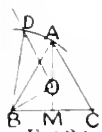


Fig. 2, b.

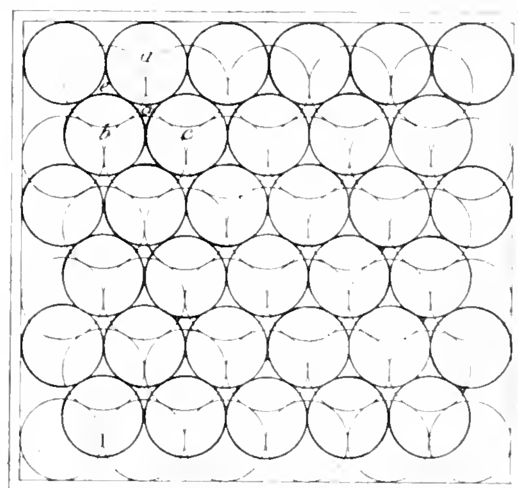


Fig. 2. a.

orange of 2nd layer, lies farther than *a* from the side by a distance equal to $\frac{1}{2}$ *ao*, or OM in fig. 2, *b*. That is each row in the upper layer overlaps by $\frac{1}{3}\sqrt{3}$, or ·58 inch, a row in the lower layer. (This, of course, is true of every layer; only in the arrangement illustrated the rows in the lower layer overlap the rows of the layer above *towards*, not *from*, the side shown at the top of the figure. Adding ·58 to 10·65, we get 11·23 inches, so that the upper layer, like the lower, can contain 6 rows; and yet lie within the breadth ($11\frac{1}{4}$ inches) of the base. Thus in each layer we get 6 rows of oranges, the rows containing alternately 6 and 5 oranges; so that each layer contains 3 times 11, or 33 oranges.

We must next determine how many layers we can get within the depth of $11\frac{8}{10}$ inches. For this we must find how much higher the centre of an orange e is above the level in which lie the centres a, b, c. But for convenience (so that fig. 2, b, may still suit us) we may suppose an orange set in the space above o, fig. 2, b; for clearly we shall have the same height in one case as the other. The centre will lie in the perpendicular from o, and at a distance of 2 inches from b, as in the other case, illustrated in fig. 1, b. Thus if we draw OD perpendicular to OB in fig. 2, b, and with BA (=2 inches) as radius describe the arc AD around B as centre cutting OD in D, we clearly have OD equal to the height we require, by which the centres of the oranges in one layer are above those in the next below [or $OB = ob$, $BD = 2$ inches, and BOD is a right angle). But since $BO = OA = \frac{2}{3}\sqrt{3}$, and $BD = 2$, $OD^2 = 4 - \frac{4}{3} = \frac{8}{3}$, and $OD = 2\sqrt{\frac{2}{3}} = \frac{2}{3}\sqrt{6} = \frac{2}{3}\ (2{\cdot}4495) = 1{\cdot}633$ inch. By this amount each layer rises above the layer next below; and as the lowest is 2 inches high, and the total height is 11·8 inches, we divide 9·8 inches by 1·633, getting 6 as the number of layers above the lowest, the 7 layers reaching to a height of $2 + 6 \times 1{\cdot}633 = 11{\cdot}798$ inches, or falling just within the depth of the box.

The total number of oranges, since each layer contains 33, is 7×33, or 231, as required.

PUZZLE XVIII. Box No. 3 is cubical—the inside length, breadth, and depth being $11\frac{9}{10}$ inches—and in this box 256 oranges are to be packed.

Here the arrangement adopted must be that shown in fig. 3, where the dark and light circles are to be understood

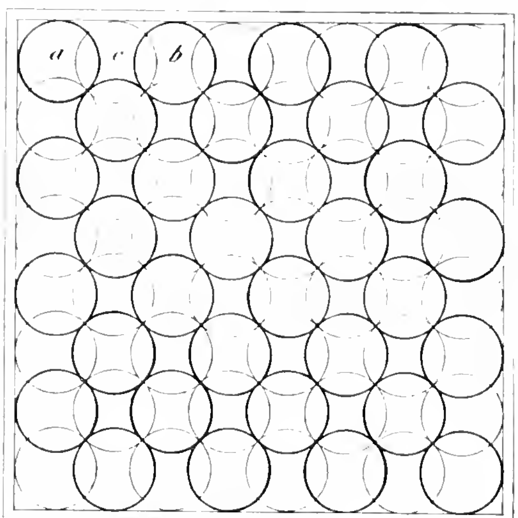


Fig. 3.

as before. Here the rows range from each other as the layers do in the first arrangement, so that, as shown by aid of fig. 1, b, in considering that case, 8 rows occupy a breadth of 11·89 inches. (We may regard a, b, and c in fig. 3 as corresponding to a, b, and c in fig. 1, a.) Moreover, we observe that the arrangement of oranges in each layer of this third box is, in a sense, the same as in the layers of box No. 1, the centres of four adjacent oranges forming a square 2 inches in the side, as in that case. Hence the layers range in height in the third case precisely as in the first, or there are 8 layers.

Since, then, there are 8 layers, and 32 in each, as fig. 3 shows, there are in all 256 oranges, as required.

It will be readily seen that the arrangement in the solution of each puzzle is the best for that special case. If we try in box No. 1 the arrangement used in box No. 2, we get in 4 layers of 30 and 3 of 25, or only 195 oranges; if the arrangement used in box No. 3, we get in 4 layers of 25 and 4 of 24, or only 196. Again, if in box No. 2 we employ arrangement No. 1, we get in 4 layers of 30 and 3 layers of 26, or only 195 oranges; and if in box No. 2 we employ arrangement No. 3, we get in 8 layers of 28, or only 224 oranges; lastly, if in box No. 3 we employ arrangement No. 1, we get in 8 layers of 25, or only 200; while if we employ arrangement No. 2, we get 7 layers of 30, or only 210 oranges.

As regards closeness of packing, the methods are in one sense identical, a dozen or so of oranges in the middle of any box being arranged relatively to each other precisely like a set of as many which can be taken from the middle of any other box. But, considered with reference to the several boxes, the methods of packing are not equally close. We may clearly represent the closeness of packing for No. 1, No. 2, and No. 3 by the number in each box divided by the cubical content of the box, getting the respective expressions $\frac{200}{(11)^2 \times 11{\cdot}9}$, $\frac{231}{12 \times 11{\cdot}23 \times 11{\cdot}8}$, and $\frac{256}{(11{\cdot}9)^3}$. On deducting the values of these expressions, which can be very easily done by logarithms, we obtain the following proportion:

Packing No. 1 : Packing No. 2 : Packing No. 3 : : 1389 : 1453 : 1516.

Thus the packing is considerably closer in box No. 2 than in box No. 1, and in box No. 3 than in box No. 2.

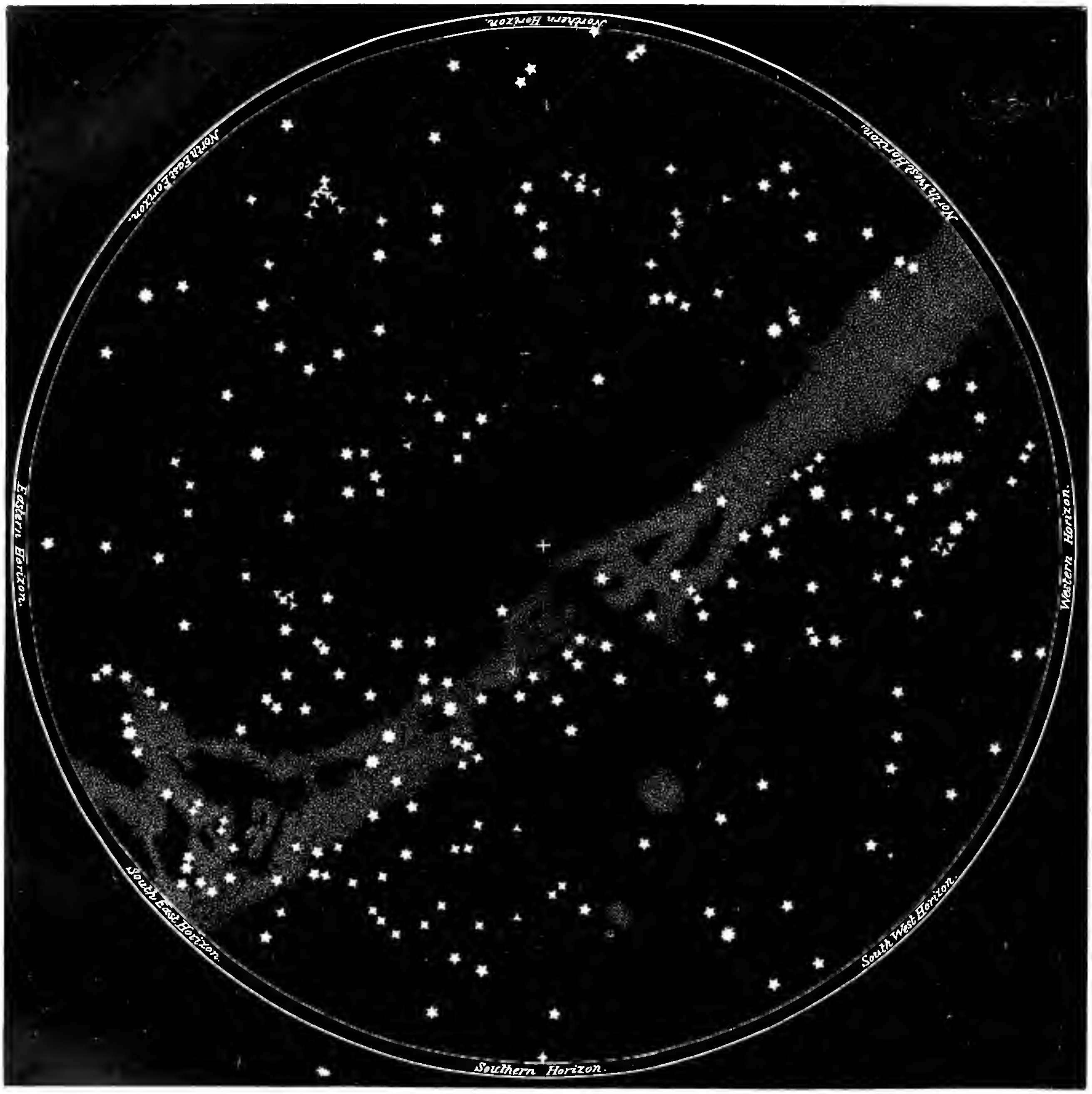
PAST AND PRESENT VOLCANOES.

AGAIN great volcanic disturbances remind us of the energies which our earth once possessed. For they err who imagine that the uniformitarian theory, which has replaced among the geologists of our day the catastrophic theory of former times, implies forces of disturbance as great now as they were during past ages of the earth's volcanic history. The processes of upheaval and down-sinking which affect the earth's crust proceed uniformly now, the catastrophic action witnessed in earthquakes and volcanic eruptions being as nothing compared with the steady but irresistible movements all the time going on. Nay, one may almost say that eruptions and earthquakes indicate rather the interruptions of the earth's vulcanian work than its true progress. But the steady, as well as the catastrophic, action of the earth's internal forces must be recognised as far weaker now than it was in former ages. The two forms of force are doubtless related to each other in a nearly constant proportion, so that one may be inferred when the other is known. Hence, though we cannot tell from any direct evidence the energy of steady upheaval and contraction possessed by the earth in past ages of her history, for we have full evidence only as to work done and no sufficient evidence as to the time occupied in doing the work, we can safely infer what that energy was by noting the evidence of the tremendous energy with which the interruptions to that steady work went on.

Unquestionably the extrusion of matter in volcanic eruptions was a much more important work in past ages than now. We cannot go back, indeed, to the beginning. We cannot even form an opinion as to the volcanic energies of the earth in Cambrian and Silurian times, which were by no means the earliest, though they are the earliest of which we have clear palæontological records. The eruptive powers of the earth during the whole of the primary age must have been enormously greater than during the secondary age; but the tremendous results of the action of primary volcanoes have been removed millions of years since by subaërial denudation. The eruptions of the secondary age, again, must have been far more tremendous than those of the tertiary age; but even of those we have but few records left. In fact, we need only consider the condition in which the products of tertiary volcanic action are now left for our study to understand how utterly unsatisfactory and imperfect must be the evidence extant in regard to the volcanoes of the secondary and primary periods.

In our own isles we find very remarkable evidence of tertiary volcanic action, yet is that evidence at least as impressive in what it suggests but leaves unsaid as in what it actually reveals. The isles of Mull and Skye may be regarded as the wrecks of enormous volcanic mountains of the tertiary age, probably more than a million years old. Each was about 30 miles in diameter, and each about 13,000 feet, probably, in height. Each continued for many thousands of years to eject from time to time enormous masses of various kinds of lava, as well as scoriæ and lapilli, such as Vesuvius and Etna eject, but in much greater quantities. Of the size of those great volcanoes, and of the tremendous energy of their eruptive powers, we have very clear evidence. But the evidence wanting speaks in its silence more impressively by far than the evidence still remaining. Of the vast mass of either volcanic mountain but the merest fragments are now left. Low mountains, little more than hills, certainly not more than a fourth the height of the former mountain masses, show where these active volcanoes once stood. All the rest has been worn and washed away by rain and wind, and snow and storm. So far back as the memory of man runs, Skye and Mull were as they are now, so slowly, though so steadfastly, do the denuding, like the upheaving, forces of the earth do their work. Yet the clear signs remain that masses not merely larger but many times larger than the whole present mass of either island above the sea-level have been destroyed. Probably seven-eighths of the former material above the sea-level has been carried away, and is now beneath the waves of ocean. If all this has been done since the tertiary age, what chance can there be of our detecting more than the merest fragments of the volcanic products of the much-longer secondary and primary periods, even though these volcanic products were ejected on a much grander scale? In yet another, and, indeed, a much more striking way, have the interior forces of the earth in the tertiary period left records of their energy. In Montana and Wyoming a tract as large as France and Germany together was covered with basaltic lava to a depth of from six or seven hundred to three or four thousand feet. In the region now occupied by the British Islands, again, from Antrim to Mull and Skye and far northwards, even perhaps continuously to the Faroe Islands in one direction and to Iceland in another, similar masses were poured forth. In the Giant's Causeway this basaltic lava has a depth not exceeding anywhere 800 feet. But among the islands opposite the western shores of Scotland there are places where the lava shows a depth of more than 3,000 feet. In the Faroe Isles a depth four times as great is indicated. The very circumstance, however, that we can determine the present thickness of these immense lava beds, compared with which all that has ever been poured out by Etna and Vesuvius, or even by Hecla, is but as a lake compared with the sea, tells us that the original thickness must have been much greater, and that the quantity which has worn and crumbled away under the action of the denuding forces of air and water must probably have equalled, if it did not exceed, even those immense masses which still remain. On the north-eastern shores of Ireland and along the south-eastern parts of Scotland we see where the ocean has cut its way into the basaltic lava, casting down the columnar blocks into which the lava had formed itself as it shrank. The regularity of the hexagonal form in most parts of the causeway is as directly a result of physical law, it may be mentioned, as the hexagonal form of the honeycomb. The basalt simply gave way, in shrinking, where resistance to cleavage was most easily overcome; and so, where uniform in material, produced uniformly hexagonal blocks, just as the bee working so as to use up the least amount of wax produces hexagonal cells, unconscious of the fact that it is working out a pretty mathematical problem. While the slow wearing away of the basaltic masses by the sea waves went on, the whole upper surface was undergoing steady denudation. Frost and thaw, snow and rain, the drying action of the sun, followed by the work of the wind in removing the dust into which the rock has been always crumbling at its surface—all these processes, scarcely affecting the aspect of the region appreciably in many centuries, must have removed a large proportion of its original mass during the hundreds of thousands of years which have elapsed since it was extruded. In Montana and Wyoming, indeed, we find comparative youth; but the way in which such youth is indicated shows what an extreme old age it signifies as compared with the periods by which we measure history. For the rivers and torrents, which in past ages have worked those channels into the rock which are called cañons, have not as yet worked their way down more than seven or eight hundred feet, many having run dry after doing that portion of the work of channel carving. When we see how slowly even the fierce rapids and mighty falls of Niagara cut away the rocks between and over which they rush, we can infer the vastness of the periods of which the great cañons of the north-western States give evidence.

All the work which Etna and Vesuvius have done since they first existed as volcanic outlets belongs but to the closing and comparatively restful portion of the history of the great mountain system of Southern Europe. They are but flank outlets, no more to be compared with the original fissures through which the core of the Alps was extruded millions of years ago, than the small side craters on their own slopes with the chief vents by which Etna and Vesuvius afford the internal forces of the earth relief. For hundreds of thousands of years those original fissures poured forth molten masses. For still vaster periods the region of fissure-ejection sank beneath a wide-spreading sea: foot by foot, yard by yard, mile by mile, the trough sank and sedimentary matter was deposited in it (so that the sea remained ever shallow), till strata ten miles deep had been formed. Then, during hundreds of thousands of years, the sea-floor, shrinking all round, shouldered up the great core of deposited matter, bending, grinding, and contorting it till, with the tremendous heat generated in the process, its whole character was altered. Denuding forces carved and chiselled out of the heterogeneous material the mountain peaks which now alone remain of the upheaved dome-shaped masses. Along the chief lines of original disturbance there is now no longer volcanic activity. On the flanks even volcanic action has for the most part died out; but far away from the core, flanking the flanks as it were of the great mountain ranges, we find a few disturbed regions, whose outlets we see in Etna, Vesuvius, Stromboli, and the rest. An outburst like the one lately in progress, representing as it does but a remnant of a remnant of the past vulcanian energies of South Europe, attests most strikingly the overwhelming might of those energies in the past.—*Times.*



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE.—For Index Map see opposite page.

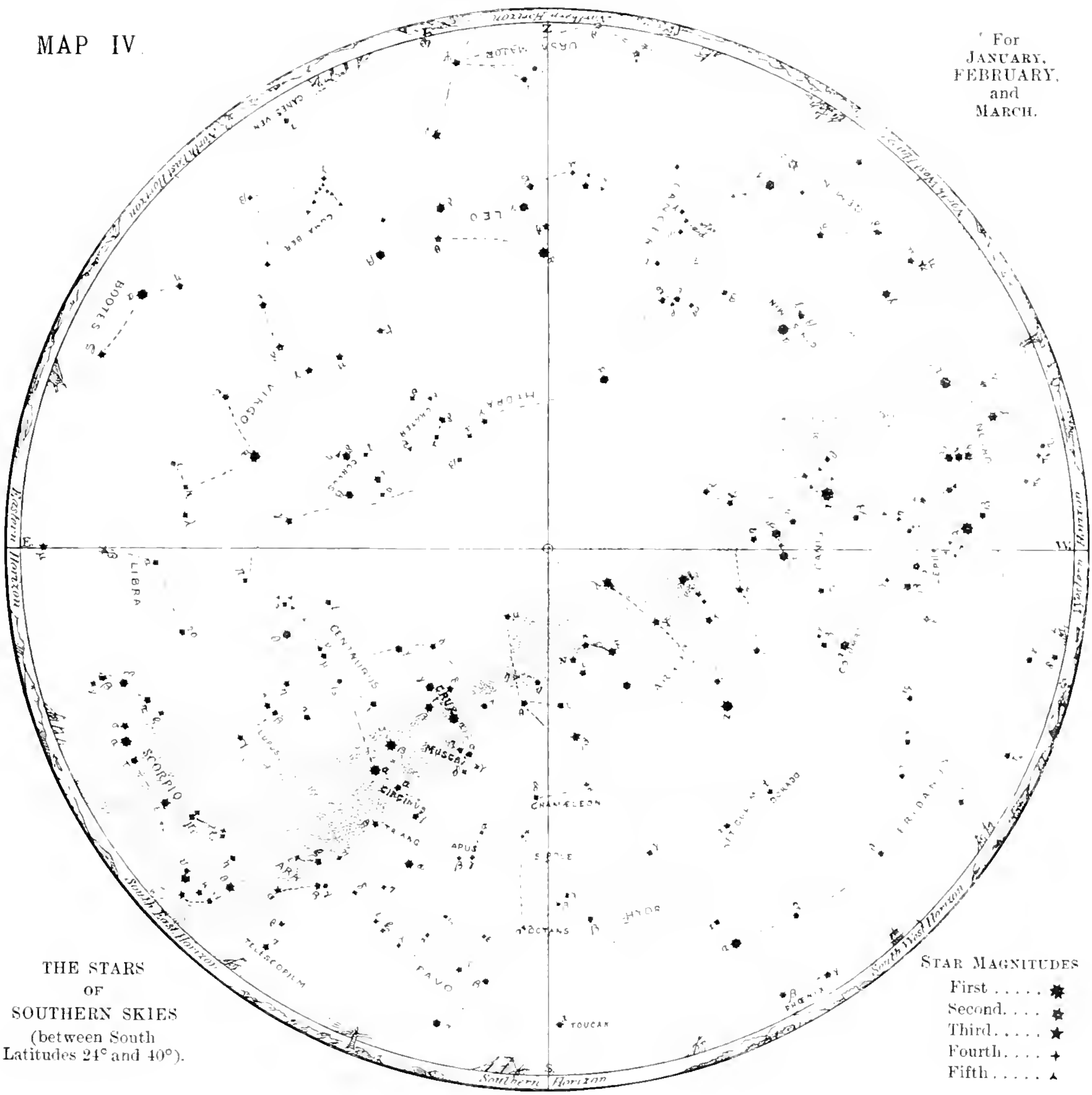
THE SOUTHERN SKIES.

By RICHARD A. PROCTOR.

OWING to the ingeniously-disturbing arrangements made by the Post-office authorities in regard to the American mails, I have not yet received proofs of the map which will appear in this month's KNOWLEDGE. Fortunately, the explanatory letterpress accompanying the maps which have already appeared will suffice to show how the map of this month is to be interpreted. It will be understood that in this map, as in the others, the horizontal line E O W marks the horizon for England, the prime vertical for the Southern heavens.

MAP IV.

For
January,
February,
and
March.



THE STARS
OF
SOUTHERN SKIES
(between South
Latitudes 24° and 40°).

Star Magnitudes
First . . . . .
Second. . . .
Third. . . . .
Fourth. . . .
Fifth . . . . .

The Night Skies in the Southern Hemisphere (Lat. 16 to 24° S.) and the Southern Skies in England (Upper Half of Map only):—

At 1 o'clock, morning	February 6.	At 10 o'clock, night	March 23.
„ 12.30 „	February 14.	„ 9.30 „	March 30.
„ Midnight	February 21.	„ 9 „	April 7.
„ 11.30 o'clock, night	March 1.	„ 8.30 „	April 14.
„ 11 „	March 8.	„ 8 „	April 22.
„ 10.30 „	March 16.	„ 7.30 „	April 30.

ONE-SCALE ATLAS.

MAP No. 11. is unavoidably postponed till next month.

THE FIFTEEN SCHOOLGIRLS' PUZZLE.

WE have received from Mr. Carpmael a very full discussion of this problem, as dealt with by him in the proceedings of the Mathematical Society. For the present, however, we can only find space for the following suggestive comments by "Mogul":

I note that you omit all reference to a mode of solving the schoolgirls' puzzle on quite different principles to any of those referred to in your last article, and which mode may be thus described:

Describing the girls by the numbers 1 to 15 instead of by letters; thus let 1 remain in the same place all the 7 days, then arrange the remaining 14 in two series of 7 each, so that on each succeeding day every number shall occupy the place occupied the day before by the next number in the series—*e.g.* suppose one series commenced 2, 10, 13, &c., then 2 would always go where 10 was the preceding day, and the 10 be moved on to where the 13 was, &c. It does not require much consideration to show that one of the series will commence with 2 and the other with 3, so that each of these numbers may on every seventh day revert to the first row, and not come into it till then. The difficulty consists in arranging the other numbers so that in the rotation of the two series no two numbers who have ever once met shall ever meet again. One solution on this principle—for there are many of them—is as under:

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15

(1)			(2)			(3)			(4)		
1	2	3	1	14	7	1	13	5	1	4	11
4	5	6	15	11	8	9	10	3	12	6	7
7	8	9	5	3	12	11	7	2	10	5	14
10	11	12	6	10	2	8	6	14	3	8	13
13	14	15	4	13	9	15	4	12	9	15	2

(5)			(6)			(7)			(8)		
1	15	10	1	9	6	1	12	8	1	2	3
2	8	5	14	3	11	13	7	10	4	5	6
6	11	13	8	10	4	3	6	15	7	8	9
7	3	4	5	7	15	11	5	9	10	11	12
12	9	14	2	12	13	14	2	4	13	14	15

And the two series are:

2	12	9	15	4	13	14
3	8	6	10	11	5	7

The sixteen whist-players can easily be solved in the same way. One solution is:

(1)				(2)				(3)			
1	2	3	4	1	6	12	16	1	10	14	8
5	6	7	8	2	10	15	7	6	9	4	15
9	10	11	12	5	9	3	14	2	5	12	13
13	14	15	16	11	13	4	8	3	11	16	7

(4)				(5)				(6)			
1	9	13	7	1	5	11	15	1	2	3	4
10	5	16	4	9	2	8	16	5	6	7	8
6	2	14	11	10	6	13	3	9	10	11	12
12	3	8	15	14	12	7	4	13	14	15	16

There being three series as follows:

2	5	9	10	6
3	11	13	14	12
4	15	7	8	16

These series are found out partly by rule and partly tentatively. Where the numbers run high, the tentative part admits of so many variations that it is very difficult to hit on the right one; and I must confess that though I have almost hit upon two series of 10 each to solve the puzzle of the 21 girls going out for 10 consecutive days in 7 rows of 3 each without any 2 ever meeting twice in the second row, I have not yet quite succeeded. I wonder whether Mr. East Marsden, who in your number for March 23, 1883, gave such a very clever solution of this very puzzle, could find out the two series; for I am convinced they must exist.

MOGUL.

"Mogul" also sends a solution of the problem of 16 whist-players by the method we followed.

ASTRONOMY AT OUR EDITOR'S AMERICAN HOME.

THE following paper, while allowing readers of KNOWLEDGE to congratulate themselves on the potent influence which their faithful editor has been able to exert (for we must believe everything read in the newspapers) on the progress of astronomy in Western America, will also serve at once to give a good example of American newspaper jocularity and of the use of particular phrases in the land of the free—and easy. It is "the text of a communication to the St. Louis *Globe-Democrat*, written under the date of St. Joseph, August 21, in which the writer tells how the good people of this city have gone daft on astronomy, and how abstruse scientific problems are taking the place of practical questions of the day":—

In accordance with your positive instructions to proceed by first train to this city, "for the purpose of making a thorough investigation into the effect which the residence of Professor Richard A. Proctor in St. Joseph has had thus far upon the mental condition of its inhabitants," and to "lay the result of the inquiry before the readers of the *Globe-Democrat* without unnecessary delay," I have the honour to report as follows:

It was only when I reached Richmond and Lexington Junction, several hours distant from St. Joe, that I began to feel how powerful and widespread had Professor Proctor's influence become. While the train was resting at the junction I overhead the baggage-master saying to the conductor:

"There will be a meeting of the Pateetown Philosophical and Astronomical Society this evening. We are going to discuss the physical features of Jupiter. Can't you drop in and see us?"

"I am very sorry," replied the conductor, "but a brief lecture which I have promised to deliver before the Perigee Club of North St. Joseph will preclude the possibility of my attendance."

"On what subject will you address the club?" asked the baggage-master.

"Oh, I simply desire to lay before it a few thoughts which I have prepared on the perturbations of Uranus," replied the conductor.

It was then that I began to realise the importance of my commission, for I felt that I must be shortly landed in the very vortex of philosophical and astronomical disputation. If the railroad men, seventy-three miles away from the Professor's new American home, were filled with a burning desire to explore the mysteries of stellar space, what, thought

I, must be the passionate intensity of feeling among those who live in his immediate neighbourhood! Contemplation of the experience in store for me served only to magnify the dimensions of the task which I had been detailed to perform, and were it not that "Peanuts" came along on one of his raids through the train and pushed a volume into my hand, I might have been tempted to abandon the undertaking.

I was about to toss the book aside, thinking that it was, perhaps, a Life of Jesse James or a History of Anderson's Raid, this class of literature being popular throughout North-west Missouri, and for sale on every train, when my eye accidentally fell upon the title—"Apparent Motions of the Planets, by General James Craig." I called the "candy butcher," and, said I, "Is the General James Craig who has written this book a resident of St. Joseph?"

"Yes," replied Peanuts, "Gen. Jim Craig; don't you know him?"

"Why, of course I know Jim Craig," said I, "but I didn't know he was writing books, and least of all books of this character."

"Oh, that's where ye'r off," replied the uncultured candy butcher, "they've all got it."

"All got what?" I asked.

"This yer astronomy craze—they're all cranky on the stars."

"You don't mean to tell me that the citizens of St. Joseph are all writing books on astronomical subjects?"

"Well, pretty much all of 'em. This is Jim Craig's third—here's the other two. I sell 'em for a dollar apiece, or three for two an' a half."

He handed me the volumes. One of them was entitled "The Rings of Saturn—Are They Round or Oblong?" and the other "Density of the Fixed Stars."

"How long has this been going on?" I asked.

"Since Professor Proctor kem over," replied the boy.

He then handed me a volume on "Lunar Occultation of the Stars," by Silas Woodson, ex-governor of Missouri; another on the "Parabolic Motion of Comets," by James N. Burnes, M.C.; another on "Nebular Hypothesis," by Hon. Waller Young; another on "Meteoric Showers," by John Edwards, of the *Gazette*; another on the "Celestial Axis," by Dr. E. A. Donelan, member of the Missouri legislature, and several others on various astronomical subjects, all written by citizens of St. Joseph.

"Do you find a ready sale for these works?" I asked.

"They go beautifully," said Peanuts. "The people up this way don't read nothing else now. I can't sell no other kind of books to 'em."

"And do they pay well?"

"Yes, I should say so! There ain't much profit on 'em, but we just sell stacks."

When the train reached Plattsburg newsboys made their appearance with the St. Joseph morning papers. "Here's the *Gazette*! Full account of the discovery of a new planet!" I bought a copy. The telegraphic and local news was given a secondary place on the inside, but the astronomical intelligence appeared under flaming headlines on the first page. Such lines as "Another Triumph of Science," "A St. Joseph Astronomer Discovers a New Planet," "The Queen City of the Missouri Valley again in the Lead," "Startling Intelligence," "Rumoured Collision in the High Heavens," "A Star of the Third Magnitude Run Down by Jupiter," "August Meteors," "A Magnificent Spectacle Last Night," "Ten Thousand Telescopes Pointed toward the Sky," "Finest Display of the Season," took the place of those which usually greet the eye of the reader in the daily newspaper.

Milton Tootle, a wholesale merchant and one of the biggest capitalists in the North-West, boarded the train at Plattsburg. I introduced myself to him, and we conversed for a few moments upon the weather, the condition of trade, politics, &c., but he suddenly gave me a blow between the eyes with the question:

"Do you think that the stars which cover the universe are properly distributed through space?"

"I have not given the subject much thought of late," I replied, for I had to say something, "but my impression is that they are not."

"But why do you think they are not?" he asked.

This question took me by surprise. The subject was one I knew absolutely nothing about, and I was unprepared to discuss it. I thought I would make a break of some kind, however, so I looked him steadily in the eye and answered:

"Because Sir John Herschel tells us that, from a numerical estimate of the stars, there are more in some places than there are in others. Therefore I draw the inference that they are not properly—I should, perhaps, say evenly—distributed. It stands to reason that, if there are more stars on one side than there are on the other—there must be some difference between the——"

"Yes, yes, I understand," said Mr. Tootle, rather petulantly, I thought; "we will say no more about it. Read my book on the subject, and you will be able to talk more intelligently upon simple questions of this kind."

When the train arrived at the Union Depôt, the first sounds that reached my ear were, "Carriage here for the Mars House," "Take the street car for the Venus Hotel," "Take the Ursa Major, best two-dollars a day hotel in the city," "Step this way for the Mercury, right in the business centre."

"I want to go to the Pacific House," I said to a policeman; "where will I find it?"

"There is no Pacific House now," he said; "you are evidently in search of the Arcturus—take the 'bus."

I took the 'bus and was soon bumping through the streets of the cultured city. On the way to the hotel I observed large numbers of schoolchildren, evidently going home to their noontime lunch. Most of them carried ponderous volumes in their hands, but many had their books carted behind them in a wheelbarrow. I remarked to a fellow-passenger that St. Joseph must be a great educational centre.

"The greatest on earth," said he. "During the past two months it has become the Athens of America. Ever since Professor Proctor married a St. Joseph girl there has been a great educational revival going on here; but it was only when he came here to live that the matter began to look serious. As it is, heaven only knows where it is going to end," and my fellow-passenger sighed.

"You live here?"

"Oh, yes, I live here. I left about a month ago expecting that the epidemic would have exhausted itself before this time, but I return only to find it raging with greater virulence than ever. You see how bad it is!"

He pointed in the direction of a saloon on the window of which was the sign, "The Gemini Sample-room—sidereal entrance Sundays."

"As if that wasn't enough," he continued. "Look here!"

He pointed to a barber shop with the sign, "Transit Tonsorial Parlours," swinging across the side walk in front.

"Will you want a room with a telescope in it?" asked the clerk of the Arcturus when I had registered my name.

"No," I replied, "I want a room with a wash-stand, a pitcher of water, a bowl, and a bed in it."

"Front," said the clerk, whose diamond sparkled like a morning star, "show this gentleman to 321, fifth constellation. It is a good room," he continued, "convenient to the roof, from which you can watch the meteoric display to-night."

"I didn't come here to see meteoric displays at night," I replied, rather coldly. "If you've got a room where I can sleep comfortably you can give my share of the meteoric display to the other guests."

"Step this way," said the bell-boy, and he led the way to the fifth storey. "This is a dandy-room," he observed. "You will have a boss view of the big bear to-night."

"Will you tell me about what time I can get a boss view of a big dinner?" I asked.

"Dinner is ready now, sir. Will you have your instruments brought up to the room?"

"What instruments?"

"Your telescopes and things?" said the boy.

"I haven't got any telescopes," said I warmly. "Do you take me for a sea captain?"

"No, sir; but nearly all the gentlemen as stops here has telescopes."

"Well, I haven't. I've got nothing but a clean undershirt, two collars, a pair of socks, and some writing-paper. Lead the way to the banquet hall."

Being seated by a distinguished-looking darkey, I picked up the bill of fare. The *menu* was a remarkable one, and, as I am expected to go into the details, I give it in full. This is what I had to select my dinner from:

Menu.
Arcturus Hotel, Monday, August 18.
Soups.
Lunar Shadow, Solastic, Scorpio.
Fish.
Cetus, with Molecular Sauce; Sign of the Crab, with Zodiacal Gravy.
Meats.
Aries on Toast, Capricornus Sliced, Lepus Roasted, Taurus Steak.
Game.
Aquila on the Wing, Cervus Pie, Cygnus Stew, Lepus Fried.
Vegetables.
Potatoes Roasted à la Juno, Cabbage Orion, Onions Nebular, Cucumbers Comestic.
Drinks.
Milky Way, Tycho Tea, Corona Borealis Coffee.
Dessert.
Centrifugal Doughnuts, Periodic Pie, Ecliptic Pudding.

The food isn't as bad as it appears to be in the above bill of fare, and as soon as I had satisfied my appetite I ventured out on the street. The first man I met was Frank Posegate, manager of the St. Joseph Steam Printing Company. I asked him what he thought of the political situation, and he said:

"That isn't the question we are interested in here at present. You see, I am president of the Dug Hill Ecliptic Society, and we are collecting money to build an observatory. That is Dug Hill—that high bluff you see rising above the river to the left. We want to place an observatory on that hill that will equal the Lick Observatory in California. If we succeed in raising the money the discoveries we expect to make will dazzle the world."

"What discoveries do you expect to make, by the way?" I asked.

"We expect to discover, for instance," said Mr. Posegate, "that the planets do not follow regular paths between the stars, and that one of these days a large planet will plunge into the orbit of some of the stars and smash them all to pieces. The result, in such an event, would be disastrons to many heavenly bodies, and the flying particles of busted stars would be apt to work great injury to our growing crops. What we want is to establish a signal office on Dug Hill, so that the moment the planet strikes in among the stars we can give warning to the agricultural classes. Say, do you believe that our planetary system has not been sensibly diminished by the incessant emission which has gone on during the period of man's history?"

"No, I cannot say that I do," replied the *Globe-Democrat* reporter.

"Then read my book," said Mr. Posegate, "my book on 'Atmospheric Friction.' Read it and you will be convinced."

"Are you taking much interest in the origin of solar heat in St. Louis?" asked Mr. R. L. McDonald, one of the leading dry goods merchants, of your reporter.

"Yes, indeed," I replied; "we are probably taking more interest in solar heat just at present than in any other kind of heat, it being rather early to think of base burners, furnaces, or radiators."

"You misunderstand me," he said. "I alluded to the origin of solar heat—to the meteoric theory, so to speak. I have just written a small pamphlet of 300 pages on the subject. If you are not in a hurry I will read it to you."

I said I was in a desperate hurry, as I wanted to catch a train.

"Well," said he, catching me by the coat collar, "you understand that a pound weight which has fallen 772 feet will create a unit of heat. We know that a body falling that distance will acquire a velocity of about 223 feet a second. Now, I propose to sink a shaft 772 feet deep in this city, into which pound weights shall be continually dropped, with an apparatus for bringing them to the surface again. I expect to create an intense body of heat thereby; and when I have demonstrated the feasibility of my scheme I will organise a company to lay pipes from this shaft throughout the city, and we will be able to furnish heat at the rate of 10 cents per 1,000 feet to residences and business houses, entirely doing away with the necessity of stoves for cooking or heating purposes."

I went into a gentlemen's furnishing store to purchase a cheap necktie. When I had selected the article I wanted the clerk said:

"I don't agree with the leading article in the *Gazette* of this morning, which says that affinity, cohesion, and gravitation are the forces which are constantly tending to convert potential into actual energy."

"The devil you don't," said I, trying to make a bow-knot with both ends the same length in the tie I had just paid for; "then, what do you believe, if it is a fair question?"

"I believe that actual energy can be converted from the potential by the application of heat."

"I have seen," said I, for I felt bored, "potential converted into actual energy by the application of a boot."

The clerk wasn't crushed. He simply replied, "Yes; but that is what we call mechanical energy—the boot being, let us say, projected at an angle of forty-five deg——"

But I fled.

I went into a saloon to get a glass of ginger ale, and, as I stirred the sugar at the bottom, the barkeeper said:

"I have been thinking all morning that the vibration of a free pendulum in a vacuum can be explained only on the supposition that a moving body always tends to move in a straight line, and with an unvarying velocity."

"I quite agree with you," said I, "let me illustrate." I took my drink and made a bee line for the door.

There is not a solitary spot in this town where a man can go to escape from them—yes, there is just one place in all St. Joseph where astronomy and its attendant evils are not discussed. That is at Professor Proctor's home. The weary stranger, driven to the verge of madness, will find an asylum of rest and repose in the house of the Professor's family, and there only. Only two men have attempted to talk astronomy to the eminent scientist since his arrival here. One of them was found in the Professor's well a few weeks later; the other has, it is believed, been used to test the strength of some new chemical acids which the great astronomer has recently invented.

The above is all I have been able to gather on the subject. Respectfully submitted, ANTARES.

Gossip.

By Richard A. Proctor.

A person who proposes to write lives of great men of science, but who "does not pretend to know anything about the subjects in which those men of science became distinguished," asks me if I will not revise his "Life of Copernicus" for the press. No, emphatically, I will not. Nor will I revise a betting bookmaker's list of swindling wagers. Nor have I any hints to offer in aid of any other system of wrong-doing.

* * *

My Bristol correspondent tells me I have wronged him, for which I am sorry. He also implies that his one sole object is to make me admit that the Bible is grander than the solar system. I take it the Bible was a product, directly or indirectly, of our earth, which is a part of the solar system. A product of a part cannot be greater than the whole. But if my angry friend will write out an abstract of the first two chapters of the Book of Proverbs, he will not waste paper, and he may learn a lesson, which a careful study of the Book of Job will strengthen. He will not guess my meaning; but I can't help that.

* * *

An odd mistake appeared recently in an American paper. A translation from a note by M. Camille Flammarion appeared with the strange suffix, "From the *Camilla* (Ga.) *Flammarion*" (Camilla is the name of a small town in Georgia, and *Flammarion* is supposed to be the name of a local paper). There have been odder names, too.

* * *

A correspondent asks my opinion on the assumption made by Kövesligethy that the solar system is travelling towards the part of the star-sphere in R.A. 216°·0 and N. Dec. 35°·1, whereas in the *Encyclopædia Britannica* I have assumed the direction of the sun's motion to be towards R.A. 260° and N. Dec. 30°. In the first place, my opinion is that the sun's motion in space cannot be regarded as determined with any approach to accuracy. In the large plate of proper motions at the end of my "Universe of Suns" the various determinations made by the elder Herschel, Argelander, Mädler, O. Struve, and others, are shown, and it will be observed that the position I indicate in the *Encyclopædia Britannica* is a very fair mean of all those widely different positions. I cannot but fancy the 216° of Herr K.'s assumed apex for the solar way must be a misprint for 246°, as none of the determinations made by astronomers fall in Bootes, as this value for the R.A., with 35° for the North Dec., would set them. If, however, Herr K. has trusted in spectroscopic evidence to determine the position of the point towards which the solar system is travelling, I can understand any amount of error. For though, as I long since pointed out, the spectroscopic evidence will probably be hereafter found the most trustworthy we can have on this subject, it is at present altogether too imperfect to be used in the discussion of such a problem as this. I would refer my correspondent to my "Essays on Astronomy," in which the whole subject is fully dealt with; but that book is now out of print, and I cannot in the present depressed state of affairs go to the expense of publishing a new edition. Perhaps when a larger public is able to turn from business anxieties to scientific studies I may do so. But it will probably be a long time hence.

* * *

The following letter, like the one last referred to, is of somewhat ancient date, being now more than six months old. I found it among a batch received when I was leaving England in June 1885, and put away so carefully as to have escaped notice till now:

> If, as you suppose in your first paper in the April number of Knowledge, the Jewish Passover was originally a feast in celebration of the passing of the sun over the equator at the vernal equinox, how do you account for the fact that the time of its celebration was determined without any reference to that astronomical event? This very year, for instance, the Passover, reckoned as of old from the first new moon in April, fell on April 20, nearly a month after the equinox. R. M. Spence.

* * *

There is no difficulty whatever in the point to which Mr. Spence here refers. We know that primarily the equinoxes were determined from the moon's motions, and the religious festivals or fasts associated with astronomical events had their origin in times when astronomical observations were, as yet, only rough. But apart from this, the rules assigned for determining the days for such festivals and fasts must be such as the unlearned can conveniently apply. No one doubts that the week had its origin in the moon's motions, or that originally it was really determined by the moon's quarters, and so had to be corrected, as in later times the year had to be. Yet now it goes on upon an easily followed method, Sabbaths and Sundays having no connection with the moon's movements. So naturally was it with the two great annual movable festivals of the Jewish calendar.

* * *

Mr. Spence added an interesting postscript:—

> The following extract from a letter which I sent to the *Scotsman* on December 29, 1883, may not be without interest to you:
>
> "On what historic grounds are we asked to regard December 25 as the anniversary of the Nativity? Not on the authority of Scripture, for it is silent. Not on the authority of the early Fathers, for about a natal day they, too, with one exception, are silent; and that one exception, Clement of Alexandria, when he wrote his 'Stromateis' (A.D. 190–202), had never heard of December 25 as the day in question. He says ('Stromateis,' i. 21): 'There are those who have determined not only the year of our Lord's birth, but also the day, and they say that it took place in the 28th year of Augustus, and on the 25th day of Pachon' (May 20). 'Others say that He was born on the 24th or 25th of Pharmuthi' (April 19 or 20). 'Not till the fourth century do we hear of December 25. It was then ingeniously adopted by the Western Church, not on historic grounds, for they had none to go on, but to make the appearance of 'The Sun of Righteousness' coincide with the resumed upward march of the natural sun, and to rival, and ultimately displace, the Pagan festivals which celebrated that physical event."

* * *

A correspondent sends me many interesting and curious particulars relative to the names Chrishna, Jeseus, the mystic Yes, Chres, Chris, Christos, &c., of which I may hereafter make use.

* * *

A correspondent in America (whence, by the way, I have had many valuable hints) sends the following much prettier (though practically the same) solution of the problem of the sixteen whist-players:

1st day	1st set.	Ann, Henry, Jane, Andrew.
	2nd „	Mary, John, Susan, Frank.
	3rd „	George, Laura, Tom, Sarah.
	4th „	Charley, Clara, William, Kate.

2nd day	1st set.	Ann, Laura, William, Frank.
	2nd „	Mary, Clara, Tom, Andrew.
	3rd „	George, Henry, Susan, Sarah.
	4th „	Charley, John, Jane, Kate.
3rd day	1st set.	Ann, Mary, George, Charley.
	2nd „	Clara, Laura, John, Henry.
	3rd „	Jane, Susan, Tom, William.
	4th „	Sarah, Kate, Frank, Andrew.
4th day	1st set.	Ann, Clara, Susan, Sarah.
	2nd „	Mary, Laura, Jane, Kate.
	3rd „	George, John, William, Andrew.
	4th „	Charley, Henry, Tom, Frank.
5th day	1st set.	Ann, John, Tom, Kate.
	2nd „	Mary, Henry, William, Sarah.
	3rd „	George, Clara, Jane, Frank.
	4th „	Charley, Laura, Susan, Andrew.

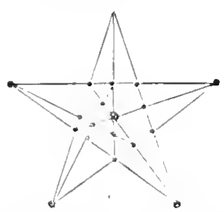
Q. E. D.

* * *

The prison puzzle in the December number ("Gossip," p. 43) may be solved in many ways if only the first few steps are rightly taken. These steps must take the prisoner into either of the cells adjoining his own, and back into his own, after which he passes out through the other neighbouring cell, and can thence find his way to the gate (fulfilling the conditions) in more ways than I care to count. It seems to me that this puzzle is rather a sell, because the prisoner certainly has to go twice out of his own cell, and can hardly, therefore, be said to have gone once, and once only, through it. However, there is no better solution; and, as I would not promise any solution at all, I have not been worse than my word.

* * *

I have received another solution of the nineteen trees in ten rows problem, as shown in the accompanying figure. The same correspondent remarks that solutions given in figs. 2 and 3 (Knowledge, for November) are in reality identical. I do not agree with him in this. For wherea



in one arrangement the trees at the angles of the outside triangle fall towards the same direction (from the centre) as the bases of the interior triangle, in the other they fall towards the same direction as the angles of that triangle.

* * *

It is told of Colonel Horatio Ross that, besides being able to shoot straight and stalk deer staunchly—qualities of themselves sufficing, in days which made Archer a sort of minor god, to raise him into the ranks of the major heroes—he was "second" in sixteen duels. The manner of his seconding was far worthier to be recalled than the mere fact, which, did it stand alone, might mean little to his credit. In every case he brought the principals to an amicable and honourable understanding. This speaks volumes for his sense and kindliness.

* * *

It must have been another Colonel Horatio Ross who used to tell a story of a brutally-planned steeplechase, in which, following instructions, he rode down and nearly killed a brother-officer, adding the semi-idiotic comment that, he supposed, "in these shopkeeping days" had he killed the other man—Captain Douglas—"it would have been called wilful murder—but it was not so in 1826—the verdict would then have been justifiable homicide."

It would seem we have improved in some respects—any way, in the sixty years since the time of the first "Locksley Hall." Though it is not "shopkeeping" which has taught us to regard savage horseplay with contempt. Napoleon said we were "a nation of shopkeepers" years before the gallant exploit of that other and inferior Colonel Ross. (The latter may have intended some subtle reference to that most multitudinous of all shopkeepers who erst presided over the naval, and later over the military, affairs of Great Britain.) There is no more necessary connection between shop-keeping and common sense than there is between the soldier's trade and such loutish ruffianism as the late Colonel Ross commended.

Reviews.

Pond Life: Insects. By Edwd. A. Butler, B.A. B.Sc. (London: Swan Sonnenschein, Lowrey, & Co. 1886.)—This fresh volume of the "Young Collector" series will suffer nothing in comparison with those of its predecessors, of which we have spoken so favourably on former occasions in these columns. Readers of Knowledge will need no reminder from us of the charm of Mr. Butler's style, and will readily accept our assurance that in his most recent volume our valued contributor is as readable and entertaining, as well as scientifically exact, as ever. Everybody who is ever likely to spend ten minutes on the bank of a pond should buy this excellent manual straightway.

Anniversary Address of the President of the Royal Society of New South Wales, delivered May 6, 1885: Local Variations and Vibrations of the Earth's Surface, and Results of Rain and River Observations made in New South Wales. By H. C. Russell, B.A., F.R.A.S., &c., Government Astronomer for New South Wales. Sydney, N.S.W., 1886.—In the three pamphlets whose titles head this notice the Government Astronomer at Sydney has made a valuable contribution not only to our knowledge of the local condition of the earth's crust, and of the meteorology of New South Wales, but to terrestrial physics generally. The European astronomer and physicist will be most interested in Mr. Russell's description of the apparatus he has erected on Lake George for automatically recording the height of the water, such height varying and oscillating with every undulation of the surface of the earth. While his instrument lacks the extraordinary delicacy of Professor Darwin's pendulum and reflecting mirror, yet while any change in gravity, or in the direction of the vertical, in the latter case only affects a base of a few feet, or at most a few yards square, in the case of Lake George we have it acting on a surface twenty miles long by some five or six miles wide. Some of the results are very curious. Just as in Europe the pendulum has been noted to swing northward, or away from the Equator, during the day, and towards it at night; so at Lake George the water runs away from the equator in the daytime and approaches it at night. Mr. Russell further applies his results to the investigation of the alleged tilting of the piers of transit instruments, a portion of his work of considerable interest to the practical astronomer, and deals with the alleged rise of the land about Sydney, &c., &c.; in fact, as we commenced by saying, he has really made a valuable contribution towards our knowledge of the physics of the earth's crust.

First Year of Scientific Knowledge. By Paul Bert. (Relfe Brothers.)—We have no school-book of elementary science which approaches this admirable work of the lamented governor of Tonkin. There is not a dry page nor a dull paragraph in it. Stones and soils, as well as birds and flowers, are treated in a clear, chatty style, which almost makes us forget how solid is the closely-packed knowledge which it conveys. Each section is followed by a summary and by subjects for composition, while the numerous illustrations, although small in scale, are drawn with accuracy and high finish. Unlike most books, the book, like a bishop, has not suffered by translation, the excellence of which is due to Madame Bert, herself a Briton. We note an error on p. 142, where it is stated that "the earth grew cooler by turning and rolling through space," this being the opposite of the fact. Heat is a form of energy, and the cooling of the earth is due to the loss of that molecular energy which it derived from the impact of its particles as they were drawn from the gaseous to the solid state.

The Granite Crags of California. By C. F. Gordon Cumming. (William Blackwood & Sons.)—Miss Cumming is the cheeriest of globe-trotters. Age cannot wither nor custom stale the variety of her trips and the vivacity of her descriptions. If her drawings fail—as all attempts of the kind must fail—to make us realise the astounding heights of the trees and waterfalls of the Yo-Semite valley, the letters which compose this book give vivid impressions of a country which is a veritable paradise for farmers and wine-growers. The striking geological features of the cañons, or great chasms of the American continent; the marvellous growth of San Francisco from a log settlement on swamp and sand plain to a city of 300,000, for whom the beneficent authorities provide a free railway, and whose dead are made life-like by the art of the enameller and the dentist, and laid out in caskets lined with the loveliest rose satin; stories of the gold fever and of the merciless wars between Christian whites and Heathen reds; these, and the freshly-written descriptions of Californian scenery, are the chief features of a book which it is a pleasure to read from cover to cover.

Ancient Legends, Mystic Charms and Superstitions of Ireland, with Sketches of the Irish Past. By Lady Wilde. (Ward & Downey.)—Now that folk-lore has taken rank as a serious study, and the stories of beldames are found to preserve the beliefs of a barbaric past, we expect a collector to be more than a story-teller. The accomplished compiler of these volumes has done her work so well that we regret she has not done it better. The myths and legends are all of deep interest and value, and have seemingly not been touched-up in transfer from oral to written form, but the defect, so far as their value to the student of comparative mythology is concerned, is that only the scantiest clues are given to the districts whence they were gathered. The fullest information should have been furnished with each tale as to narrator, place, and circumstance; and we hope that the issue of a second edition may enable Lady Wilde to supply this omission, as well as to add an index. Her introductory chapter on the origin and isolation of Irish legends is based upon antiquated theories, while the closing chapters on the past history of the island are marred by references to "pre-Adamic rudimental humanity," which imply retention of beliefs long discredited by anthropologists.

Marcella Grace. By Rosa Mulholland. (Kegan Paul, Trench, and Co.)—We do not leave Irish soil in passing to notice this book, which lies in some danger of neglect amongst the pile of novels of a season. This should not be, for the story is one of singular strength and pathos, having special interest at the present time, when men's minds are troubled with the "Condition of Ireland" question. Not that Miss Mulholland obtrudes party politics into her vivid pictures of the peasantry and of the restless plotters who work wild, rough revenge on the land-grabber and the ejector; but the political side of social troubles cannot be ignored as giving significance to the story. The heroine is no puppet of the three-volume pattern, and the prison-scene in which her lover, on the eve of trial for a crime in which he had no part, dissuades her from perjuring herself to save him, is written with remarkable power. The book evidences throughout great pains on the authoress's part, and we commend it heartily to our readers.

In connection with it, we welcome the re-publication of *The Late Miss Hollingford*, an early tale of skilful construction by the same authoress, which was a great favourite with Charles Dickens. Messrs. Blackie and Son are the publishers.

In the Wrong Paradise and Other Stories. By Andrew Lang. (Kegan Paul, Trench & Co.)—The story which gives its title to this sparkling book is very amusing. Each religion has its own paradise, and the fun—to the reader—consists in the departed getting into the wrong place. A Presbyterian minister finds himself in the paradise of the Ojibbeways, where he makes sport for the spirits, who scalp him at intervals, the scalp growing again immediately to permit repetition of the operation. In like manner a serious and shy University man finds himself amongst bright and large-eyed houris in the "transcendental Cremorne" of the Mohammedan paradise. But the "Romance of the First Radical" interests us most. It has the germs of the anthropological novel of the future, which is to displace Fenimore Cooper's with his *parvenu* savages. In this brightly-written but shadowed narrative of Why-Why's troubles through adoption of the new-fangled heresy of private judgment, Mr. Lang draws upon his rich store of knowledge of barbaric rite and custom. The reprint of his clever *jeu d'esprit*, "The Great Gladstone Myth," adds value to the book.

For the facts which supply material for the coming novelist of the pre-historic period, for whom Mr. Lang thus paves the way, we may call attention to two books from the pens of distinguished foreign *savants*, namely, *The Pre-History of the North*, by the late Dr. Worsaae, translated by H. Morland Simpson (Trübner & Co.), and M. de Quatrefage's *Introduction sur l'Étude des Races Humaines*, the first volume of a general history of the races of mankind, entitled *La Bibliothèque Ethnologique* (Paris: Hennuyer; London: Trübner & Co.)—Dr. Worsaae was the distinguished director of the Royal Museum of Northern Antiquities at Copenhagen, the most complete of its kind in Europe, and the book under review gives a general and pleasantly written survey of the results arrived at by comparative examination of prehistoric materials. The Danish antiquaries were the first to throw light on the earliest-known periods of human culture, and one important result was the proof of agreement between the mode of development in various parts of the world. A succinct account of the Stone Ages, the enormous break between which the learned author does not sufficiently insist upon, is followed by local illustrations of their features in Northern Europe; and in treating of later epochs Dr. Worsaae supplies interesting material bearing on the religious rites, and notably on the worship of Thor, among Northern races. If his volume adds little of novelty to the subject, it gives us the judgment of an expert upon questions of lasting interest, and it is entitled to a place by the side of Tylor, Nilsson, Lubbock, and other authorities.

The work of M. de Quatrefages, as its title implies, is more purely ethnological. In the opening chapters on the place of man in the scale of organic life and on the theories of his origin in one or more parts of the globe, the author maintains the conservative view of his earlier works. We in England are well supplied with books which, like Tylor's "Anthropology," render the present work superfluous, with the exception that we have nothing like it in the collection of illustrations conveniently grouped inside one cover.

Australiana; or, My Early Life. By RICHMOND HENTY. (Sampson Low & Co.)—There is a not unpleasant egotism running throughout this book, the author of which can boast of being the first white native of the first settlement of Victoria. He has much of interest to tell us of the aborigines of the Colony, upon whom the white man's fire-water and other poisons have wrought their devastating work, and of the early condition of the settlements at the Antipodes. We wish that the space given to descriptions of his visits to the Old World and to family affairs, including the uninteresting fact to outsiders that the author's marriage took place in the presence of a large company at St. George's, Hanover Square, had been filled with details of colonial life. Upon this, however, the author has much to say that will commend his book to intending emigrants.

Historic Towns: London. By W. J. LOFTIE. (Longmans.)—This is the first volume of a series which will treat of our principal towns with reference to the special part which each has played in the general history of England. The scheme is an admirable one, in view of the growing revival of that municipal spirit amongst us which has made England the nursing mother of free governments, and the present volume could not have been entrusted to fitter hands, Mr. Loftie having proved himself in all respects a worthy successor of the chroniclers of the annals of this mightiest and most interesting of the world's cities. We especially commend this volume to young men.

Very Short Stories. By Mrs. W. K. CLIFFORD. (Walter Scott.)—The authoress of "Anyhow Stories" gives fresh evidence, in these peeps into the wonderment of child-life and "snatches of mysterious song" which make up this little book, of that weird power which attracts the old as well as young to her stories. Thoughts, the significance of which almost escape us in the simplicity of the language, are scattered with no show of art amongst the prose and verse, some of which is new, and the rest of which we are glad to greet again in this cheap and tasty form.

All Round the Clock, by H. M. BENNETT and R. E. MACK; *Christmas Roses;* and *Under the Mistletoe*, by L. LANON and R. E. MACK. (Griffith, Farran, & Co.)—If our notice of these charming books for children is a month too late to commend them as Christmas gifts, it may, in separating them from the crowd, secure them merited attention from all well-disposed sisters, cousins, and aunts who have birthday presents in view. The illustrations in each book are of exquisite softness.

The same publishers also send us a specimen of their quaint and pretty *Court Address Book*, and of both *Pettitt's and Blackwood's Diaries.* Messrs. Philips are to the fore with a *Jubilee Atlas*, which suitably embraces maps of Great Britain, India, and the Colonies. We have also received *Whitaker's Almanack*, with the present size and contents of which indispensable annual we hope Mr. Whitaker will rest as content as we are. *St. Nicholas*, which continues to be far and away the best magazine for young folks, now passes into the enterprising hands of Mr. Fisher Unwin. In *Dickens's Christmas Carol and Chimes*, Messrs. Cassell conclude the first year of their cheap and excellent weekly issue entitled "The National Library." The most attractive feature of the current number of *Longman's Magazine* is Mr. Rider Haggard's "Allan Quatermain," a sequel to his "King Solomon's Mines." Messrs. Watson Brothers (Birmingham) send us Parts IX. and X. of Mr. Teall's *British Petrography*; and Mr. Cole his instalment of *Studies in Microscopical Science*, both of which issues maintain their high excellence in text and illustration. The current number of Walford's *Antiquarian* opens with an interesting paper, the first of a series, on "Domesday Book," and gives a sprightly abstract of that rare book of travels—"Tom Coryate's Crudities."

THE FACE OF THE SKY FOR FEBRUARY.

By F.R.A.S.

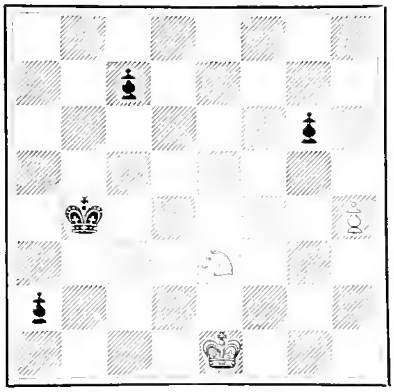
THE continued quiescence of the sun's surface renders him a very uninteresting object in the telescope. The night sky will be found depicted in map ii. of "The Stars in their Seasons." Minima of Algol will occur at 1h. 12m. A.M. on the 8th, at 10h. 1m. P.M. on the 10th, at 6h. 50m. P.M. on the 13th, and at other times too inconvenient for the ordinary amateur observer. Mercury is an evening star, and at the end of the month on very clear evenings may be detected with the naked eye a little above the horizon, somewhat to the south of west. Venus is an evening star too, and, like Mercury, may be seen for a short time after sunset at the end of February. Mars is invisible, and Jupiter does not rise until between ten and eleven o'clock at night, even at the end of the month. Saturn is visible all night long, and is a splendid object in the telescope. He is quite close to the star δ Geminorum ("The Stars in their Seasons," map ii.). Uranus is out of sight. Neptune remains in the position some $6\frac{1}{2}°$ south, and *just* to the west of the Pleiades, to which reference has been made more than once lately in these columns ("The Stars in their Seasons," map i.). The moon enters her first quarter at 8h. 26·8m. A.M. on the 1st, and is full at 10h. 43·3m. on the morning of the 8th. She enters her last quarter at 1h. 32m. A.M. on the 15th, and is new at 9h. 40·2m. P.M. on the 22nd. Of the eight occultations of stars by the moon which will happen during February, four only occur at times convenient for the amateur. They are as follow:—On the evening of the 3rd at 6h. 26m. P.M., B.A.C. 1526, a star of the 6th magnitude, will disappear at the moon's dark limb at an angle of 122° from her vertex, reappearing at her bright limb at 7h. 24m. P.M. at a vertical angle of 233°. On the 6th, 3 Cancri, a 6th magnitude star, will disappear at the dark limb at 9h. 17m. P.M. at a vertical angle of 77°. It will reappear at the bright limb at 10h. 27m. P.M., at an angle of 239° from the vertex of the moon. On the 7th, 54 Cancri, of the $6\frac{1}{2}$th magnitude, will disappear at the dark limb of the moon at 4h. 29m. P.M., at an angle of 77° from her vertex. It will reappear at her bright limb at 5h. 14m. P.M., at a vertical angle of 195°. Lastly, on the 11th, 46 Virginis, a 6th magnitude star, will disappear at the bright limb of the moon at 11h. 17m. P.M., at a vertical angle of 23°, to reappear at her dark limb at 19 minutes after midnight at an angle of 226° from her vertex. At noon to-day the moon is in Aries ("The Seasons Pictured," plate xxiii.), which at midnight she quits for Taurus. She is travelling across Taurus until 5h. 30m. P.M. on the 4th, at which hour she arrives on the boundary of the northern extension of Orion. When by 5 o'clock in the morning of the 5th she has traversed this, she emerges in Gemini ("The Seasons Pictured," plate xxiv.). Her passage through Gemini occupies her until 8h. 30m. P.M. on the 6th, when she enters Cancer; which she quits in turn for Leo, at 6h. A.M. on the 8th. She is crossing Leo until 3h. P.M. on the 10th, passing at that hour into Virgo ("The Seasons Pictured," plate xxv.). She remains in Virgo until 2h. P.M. on the 13th, when she enters Libra ("The Seasons Pictured," plate xxvi.). In the course of her journey through Libra, she comes at 8h. 30m. A.M. on the 15th to the western edge of the narrow northern strip of Scorpio. By 6 o'clock the same evening she has crossed this and entered Ophiuchus. Passing through this part of Ophiuchus and a little bit of the extreme southerly part of Serpens, she enters Sagittarius at noon on the 17th. At midnight on the 19th she leaves Sagittarius for Capricornus ("The Seasons Pictured," plate xxi.). Skirting the boundaries of Capricornus and Aquarius, after the early morning of the 21st, she finally enters the last-named constellation at 4h. A.M. on the 22nd. At 5h. A.M. on the 24th she passes out of Aquarius into Pisces ("The Seasons Pictured," plate xxii.). She is journeying through Pisces until noon on the 27th, when she quits that great straggling constellation for the north-west corner of Cetus. By 4h. A.M. on the 28th her journey across this is completed, and she has left it for Aries ("The Seasons Pictured," plate xxiii.). She is still in Aries at midnight on the 28th.

Our Chess Column.

BY "MEPHISTO."

USEFUL END-GAMES.

BLACK.



WHITE.

White to move and draw.

The above end-game position contains several points of interest which should receive the attention of chess students, and which we will endeavour to explain fully.

Firstly, in order to draw, White plays

1. Kt to B2 (ch)	1. K to B6
2 Kt to Rsq	

The opportunity often occurs to play Kt to Rsq in a similar position, and then, if the adversary's King attempts to capture the Knight, to play K to Bsq and B2 perpetually; we have shown before that, in such a position, a King alone can draw against a King, Pawn, and Knight, provided that the King occupies a square of the same colour as that on which the Knight stands, as per example Black K to QR8. P to QR7. Kt to K2. K on Qsq, White to move. White plays K to Bsq and draws, but K to B2 loses.

2.	2. K to Kt7
3. K to Q2	3. K × Kt

3. P to B4 would make no difference in the position, as White would play his K or Kt backwards and forwards.

4. K to Bsq or (*a*)	4. P to B3 !

Here we have a good illustration of the importance of losing a move. 4. P to B4 instead would have lost, as the following will show:—4. P to B4. 5. K to B2, P to B5. 6. K to Bsq, P to B6. (If P to Kt4 instead White mates in 5 moves by P to R5, &c.) 7. K to B2, P to Kt4. 8. P to R5 and mates in 4 moves. Black can only draw if he advances P to Kt4 when the White K is on Bsq, and his own P on his B6, to prevent White checking when the RP goes to Queen.

5. K to B2	5. P to B4
6. K to Bsq	6. P to B5
7. K to B2	7. P to B6
8. K to Bsq	8. P to Kt4 !

Here, again, we see that calculation and caution are necessary, for if Black had played 8. P to B7 instead, White would have won by 9. K × P, P to Kt4, and White mates in four moves.

If now 9. P × P, P to B7, and the game will be drawn. It is curious to note, however, that if White on his last move had attempted to play the move, which won in former positions, namely, 9. P to R5, it would have lost, although White Queens first, because Black will Queen with a check, as the White King stands on Bsq, and the Black P on B6 prevents White Queening with a check first. Black played 4. P to B3 instead of 4. P to B4, in order to bring this position about. If, instead of 9. P × P,

9. P to R5	9. P to Kt5
10 P to R6	10. P to Kt6
11. P to R7	11. P to Kt7
12. P to R8 (Q)	12. P to Kt8 (Q) ch
13. K to B2	13. Q to QKt8 (ch)
14. K × P	14. Q to Kt7 (ch)

and Black wins.

(*a*) Reverting again to Move 4, we find that if White plays instead of 4. K to B sq—

4. K to B2	4. P to B4 !

Black must play 4. P to B4 for the same reason which compels him to play P to B3 in answer to White's former move of 4K to Bsq, as otherwise he would lose, *i.e.* 4. P to B3; 5. K to Bsq, P to B4; 6. K to B2, P to B5; 7. K to Bsq, P to B6; 8. K to B2, P to Kt4; 9. P to R5; and mates in four moves.

5. K to Bsq	5. P to B5
6. K to B2	6. P to B6
7. K to Bsq	

and we have the same position as before in which Black plays P to Kt4, &c.

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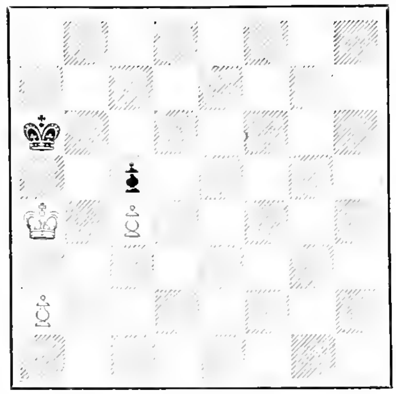


WHITE.

White to play and win.

This end-game likewise shows the importance of gaining time in order to maintain an opposition.

The White King deserves the vulgar epithet of "the sneak," for he literally sneaks into a winning position, as the following will show:—

1. K to R3 !	1. K to Kt3
2. K to Kt2 !	2. K to R4
3. K to Kt3 !	3. K to R3
4. K to B3	4. K to R4

White has already gained a most important move; for if he had simply played 1. K to Kt3, K to R4. 2. K to B3, K to R5 Black would draw, as his King is too far advanced, and does not give White time to leave his BP.

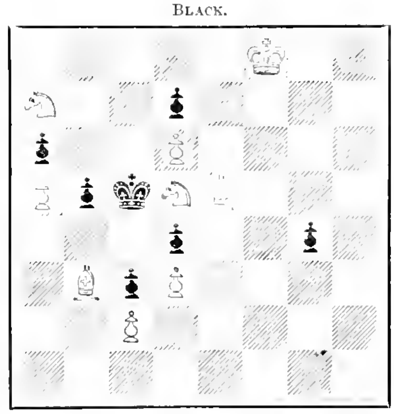
5. K to Q2 !	5. K to R5
6. K to K3 !	6. K to Kt6
7. K to Q3	And wins.

If Black plays K to R6, White captures the P, and Queens his own. Equally so if 7. K to R4; 8. K to K4, K to R3; 9. K to Q5, K to Kt3; 10. P to R3 and wins.

Attempts should be made to deviate from the above line of play, and it will be found that White cannot win otherwise than by gaining time by manœuvring his King, as shown.

PROBLEM BY RICHARD A. PROCTOR.

BLACK.



WHITE.

White to play and mate in three moves.

The author of the above problem, in contributing it to this department, says:—"I send a problem which I planned in the cars—my only opportunity for chess in any way. It is, I believe, sound, though for want of leisure I could not elaborate any difficulty worth mentioning. So if you see fit to use it, you should present it, I think, as an easy one.

"St. Joseph, Mo., November 7, 1886."

Our Whist Column.

BY "FIVE OF CLUBS."

THE *Australasian*, whose Whist column is the best now published, gives the following game as an illustration of the indirect mischief often following from the play of King second hand, from King and one other:—

THE HANDS.

B { H. (*trumps*).—10, 8, 2.
S.—Q, 6, 4, 2.
C.—K, 8, 4.
D.—Kn, 10, 9. }

Y { H. (*tps*).—Kn, 6, 4.
S.—K, 8.
C.—Kn, 6, 3.
D.—8, 6, 5, 4, 2. }

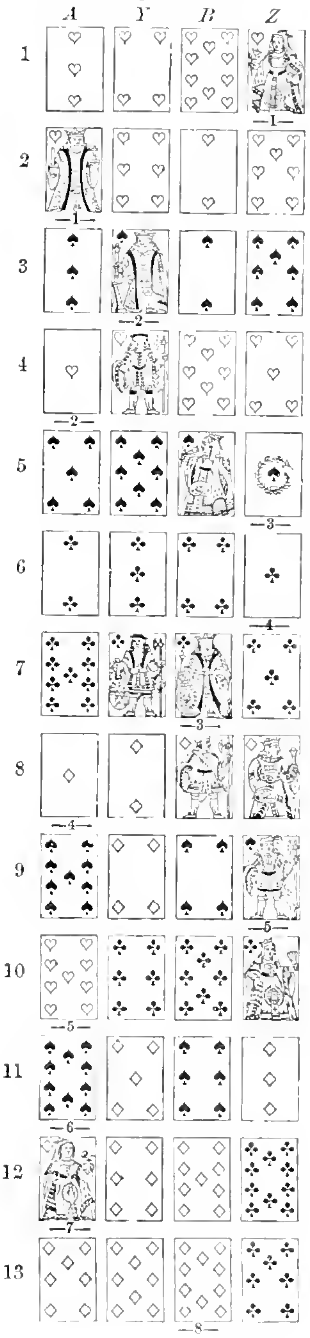
B
Y Z
Tr. H. 5.
A leads.

Z { H. (*tps*).—Q, 7, 5.
S.—A, Kn, 7.
C.—A, Q, 10, 7, 5.
D.—K, 3. }

A { H (*trumps*).—A, K, 9, 3.
S.—10, 9, 5, 3.
C.—9, 2.
D.—A, Q, 7. }

A B play against *Y* and *Z*.

Score:—*A B* two; *Y Z* three.



NOTES ON THE PLAY.

Card underlined wins trick; card underneath leading next.

1. *A* is right in leading trumps. But

2. *Z* is right also in playing them back on *A-B*. For he has Major Tenace in one plain suit, best and fourth best in another, and a guarded King in the third. Moreover, he is leading through strength and up to declared weakness. Yet this lead, through *Y*'s weak play, leads to ruin.

3. *Y* obeys the old rule, King ever, Queen never; and has the satisfaction of believing for a little while that he has gained a trick.

4. But why does he lead trumps? He should have *known* that *A* led trumps because he wanted to be led up to in trumps, while *Z* led them because he wanted to be led up to in any plain suit. *Y*'s play here destroys *Y-Z*, horse, foot, and artillery. *Y* should have led Club Knave. Would he have done so if he had remembered that *Z* still held the trump card? I doubt it.

6. *Z* must now lead from his Tenace. Had *Y* led Club Knave all would still have been well.

8. *Z* must cover.

9. By holding back the Diamond Queen *A* somewhat increases (so far as he knows) the chance of making two tricks in Diamonds. Probably, however, as turns out to be the case, *B* holds Diamond Ten.

And *A B* score two by cards.

The game should have been played as follows:—

	A	*Y*	*B*	*Z*
1.—	H 3	H 4	H 10	H Q —1—
2.—	H K —1—	H 6	H 2	H 7
3.—	S 3	S 8	S Q	S A —2—
4.—	H A —2—	H Kn	H 8	H 5
5.—	S 5	S K —3—	S 2	S 7
6.—	C 2	C Kn	C K	C A —4—
7.—	C 9	C 3	C 4	C Q —5—
8.—	H 9 —3—	C 6	C 8	C 10
9.—	S 9	D 2	S 4	S Kn —6—
10.—	D 7	D 4	S 6	C 7 —7—
11.—	D Q	D 5	D 9	C 5 —8—
12.—	D A —4—	D 6	D 10	D K
13.—	S 10 —5—	D 8	D Kn	D 3

And *Y Z* score two by cards and the game.

NOTES.

3. By holding back the King *Y* increases his chance of leading up to *Z*, as *Z* manifestly (to any Whist-playing partner) desires.

6. *Y*'s lead kills the enemy's Club King, and

7, 8 enables *Z* to force out the long trump.

12. *Z*'s Diamond King, though it falls, has been a tower of strength to him all the same. But for it and its useful guard, a Diamond lead by *A* at trick 9 would have given *A-B* three tricks in Diamonds.

It is noteworthy and full of meaning that, while members of all religious persuasions are very ready to accuse of blasphemy any who question the scientific accuracy of statements in the books they consider inspired, the converse charge of blasphemy in regarding inaccurate statements as inspired is very seldom heard. It seems to many reasonable enough to say, "You are wicked to recognise error in what God has written," but few think of saying, "You are wicked to recognise God's writing in what is erroneous." Possibly this is because the many who do not think are not only blind to error, but cannot see the absurdity of imagining men adopting a belief out of pure wickedness of heart; while the few who think for themselves not only recognise error, but see also that belief even in error cannot conceivably be a wilful sin. If a man should say to a student of zoology, "You must be very wicked to say the hare does not chew the cud, for God says in Leviticus that the hare *does* chew the cud," the student cannot retort, "You must be very wicked to assert that God says the hare chews the cud, when the hare himself declines to do anything of the sort;" for the same reasoning power which enables the student of knowledge to ascertain that the hare is really unable to chew the cud enables him also to see that the man who accuses him of blasphemy for recognising a scientific fact is really unable to recognise the absurdity of the idea.

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KNOWLEDGE
AN
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LONDON: MARCH 1, 1887.

THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

By EDWARD CLODD.

PART II.

CHAPTER IV.—THE ORIGIN OF SPECIES.

THE history of the slow but sure preparation of the scientific world for the reception of a theory displacing the old notions of the fixity of species is briefly but vividly told by Mr. Grant Allen in his monograph on "Charles Darwin." * Commending the study of that book, especially of the fifth chapter, as superseding the need for repeating the story here, we may pass at once to a rapid summary of the evidence as to the modes of organic evolution.

I. *No two individuals of the same species are exactly alike; each tends to vary.*—Of this obvious fact every species, from man downwards, supplies abundant illustration; for however closely individuals resemble one another in essential features, causing them to be grouped under the same species, there are always differences between them, often very marked, both in organ and function. Children of the same parents vary in size, feature, complexion, character, and constitution, often very obviously, sometimes too obscurely for detection; and this law of general resemblance, with more or less variation in detail, applies to all animals and plants. The tendency to vary, which, in our ignorance of its ultimate causes, we say "inheres" in the organism, and of which what are called "sports" are an example, is fostered by the change of condition in which the animal or plant may be placed, as shown in its more marked tendency to vary in a domesticated than in a wild state. Throughout these papers stress has been laid on the fact that the organ adapts itself to the work which it has to do; hence changes of structure in a species are necessitated to fit it for an altered state of things. This implies increased or lessened activity on the part of certain organs, the use or disuse leading to their development or suppression.

II. *Variations are transmitted, and therefore tend to become permanent.*—In other words, what is peculiar to the parent plant or animal reappears in the offspring. This is known as "descent with modification," the serious import of which will be shown later on.

III. *Man takes advantage of these transmitted unlikenesses to produce new varieties of Plants and Animals.*—He selects certain individuals possessing variations which he wants to preserve, and allows only them to breed together, by which means in the course of time he produces varieties differing greatly from the parent form with which he started. The stock example of this is the pigeon. All our domestic pigeons, exceeding in number a hundred well-marked races, are descended from the ordinary blue rock-pigeon of the European coasts. Variations as marked as the fan-tail, the tumbler, and the pouter, have been produced by the breeder selecting birds with certain peculiarities, and choosing from each successive brood only those which exhibited the same peculiarities in more marked form, the result being, after a long time, the production of entirely new varieties. The same method has given us different races of dogs, sheep, horses, and other domestic animals. The fleetest horses are chosen to breed together; then the fleetest offspring of these in succession, until horses are produced whose swiftness far exceeds that of the originally selected pairs. In the development of the cart-horse strength, not speed, is the quality selected: while in the marked unlikenesses between dogs we see the result of artificial selection in producing such varieties as the bloodhound, the terrier, and the spaniel. What varieties in flowers, vegetables, and fruits—as, for example, the development of the numerous kinds of apples from the small, sour, crab species—the like method has induced, are too well known to need detailed reference here. When we see how successfully this choice of slight variations has brought about plants and animals best adapted to the service of man, we may desire the approach of that future when artificial selection will be extended to the human species, so that only the men and women who are of the highest type, both physically and morally, shall reproduce their kind.

Now the important work which Darwin did was to show that what man does on a small scale within a limited range of time, Nature does on a large scale during countless epochs; with the further difference that the action of Nature is not purposive, as is the action of man, but involved in the necessities of things. We may quote what Darwin himself says on this matter:

> As man can produce, and certainly has produced, a great result by his methodical and unconscious means of selection, what may not natural selection effect? Man can act only on external and visible characters: Nature, if I may be allowed to personify the natural preservation or survival of the fittest, cares nothing for appearances, except in so far as they are useful to any being. She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life. Man selects only for his own good: Nature only for that of the being which she tends. Every selected character is fully exercised by her, as is implied by the fact of their selection. Man keeps the natives of many climates in the same country; he seldom exercises each selected character in some peculiar and fitting manner; he feeds a long and a short-beaked pigeon on the same food; he does not exercise a long-backed or long-legged quadruped in any peculiar manner; he exposes sheep with long and short wool to the same climate. He does not allow the most vigorous males to struggle for the females. He does not rigidly destroy all inferior animals, but protects during each varying season, as far as lies in his power, all his productions. He often begins his selection by some half monstrous form; or at least by some modification prominent enough to catch the eye or to be plainly useful to him. Under Nature the slightest differences of structure or constitution may well turn the nicely-balanced scale in the struggle for life, and so be preserved. How fleeting are the wishes and efforts of man! how short his time! and, consequently, how poor will be his results, compared with those accumulated by Nature during whole geological periods? Can we wonder, then, that Nature's productions should be far "truer" in character than man's productions; that they should be infinitely better adapted to the most complex conditions of life, and should plainly bear the stamp of far higher workmanship? *

IV. *More organisms are born than survive.*—To quote Darwin once more, "there is no exception to the rule that every organic being naturally increases at so high a rate that, if not destroyed, the earth would soon be covered by the progeny of a single pair. Even slow-breeding man has

* "English Worthies" Series. Longmans.

* "Origin of Species," sixth ed., p. 65.

doubled in twenty-five years, and at this rate in less than a thousand years there would literally not be standing room for his progeny."* If all the offspring of the elephant, the slowest breeder known, survived, there would be in 750 years nearly nineteen million elephants alive, descended from the first pair. If the eight or nine million eggs which the roe of a cod is said to contain developed into adult cod-fishes, the sea would quickly become a solid mass of them. So prolific is its progeny after progeny, that the common house-fly is computed to produce twenty-one millions in a season; while so enormous is the laying power of the aphis, or plant-louse, that the tenth brood of one parent, without adding the products of all the generations which precede the tenth, would contain more ponderable matter than all the population of China, estimating this at five hundred millions!

It is the same with plants. If an annual plant produced only two seeds yearly, and all the seedlings survived and reproduced in like number, one million plants would be produced in twenty years from the single ancestor. Should the increase be at the rate of fifty seeds yearly, the result, if unchecked, would be to cover the whole globe in nine years, leaving no room for other plants. The lower organisms multiply with astonishing rapidity, some minute fungi increasing a billionfold in a few hours, and the protococcus, or red snow, multiplying so fast as to tinge many acres of snow with its crimson in a night. But we need not give further examples of this fecundity whereby Nature, "so careless of the single life," secures the race against extinction.

V. *The result is obvious: a ceaseless struggle for food and place.*—In that struggle the race is to the swift and the battle to the strong; the weaker, be it in brain or body, going to the wall, the vast majority never reaching maturity, or if they do arrive at it, only to be starved or slain. As amongst men, competition is sharper between those of the same trade, so throughout the organic world the struggle is less severe between different species than between members of the same species, because these compete most fiercely for their common needs—plants for the same soil, carnivora for the same prey. But whether the battle is fought between allied or unallied species, the victory is never doubtful—it is assured to the plant or animal that has some advantage, however slight, which its opponent lacks. Among plants growing in a dry soil, those whose leaves have thicker hairs upon them will absorb more moisture from the air than plants with less hairy leaves, and competing successfully with these, will survive to transmit their advantageous variations. Again, such as are better able to resist the depredations of burglarious insects by protection of thorny or prickly stems, or by nauseous taste, will thrive and multiply, while plants lacking these defences dwindle and become extinct. So with those which by showy colours of their flowers and sweeter nectar attract insects whose visits are desired as carriers of pollen from stamens to pistils. These secure propagation, while plants less attractive remain barren. The birds that are strongest on the wing reach the land whither they migrate, while the weaker perish by the way. The lions of sharper sight and more supple spring, the wolves of keener scent, secure their prey, while the feebler members starve. It is with man as with the organisms below him: the quickest in intellect, and those with greater power of endurance, distance the weak or the stupid, who fall behind, and, finally, slip out of the ranks altogether.

But the subtlety and variety of the conditions upon which natural selection seizes escape the keenest observers. Of their success, however, in tracing the varying fortunes of species Darwin gives a striking illustration in his explanation of the absence of wild oxen and horses in Paraguay. This is due to the action of a small fly which lays its eggs in the navel of newly-born calves and foals, the maggots hatched from the eggs causing the death of the young animals. Now, supposing this parasitic fly to be destroyed by an insect-eating bird, oxen and horses would abound in a wild state, and as they would eat certain plants, the vegetation would be altered, and these changes in the flora and fauna would involve changes of increasing complexity.

The inter-relation between the proportion of old maids and an abundance of red clover is not, *primâ facie*, quite as obvious. But it may be proved in this wise. The clover is fertilised by humble-bees, the number of which is determined by the number of field-mice which destroy their nests. The number of field-mice, again, is determined by the number of cats, and the number of these finally by the number of old maids who keep them! Therefore, as red clover is excellent food for cattle, and cattle are excellent food for man, elderly spinsters are benefactors to their species!

The important part played by colour and mimicry in the struggle for life has been demonstrated by Darwin, Wallace, Bates, and other acute observers. The more closely that an animal approximates in form and hue to its surroundings, the easier does it escape detection by its pursuer, and the easier does it avoid the notice of the prey which it pursues. In conformity with this we find that most animals are protectively coloured, while those which are not are so constituted as to render such protection needless. As illustrative of the operation of natural selection in this matter, we may borrow an admirable example from Mr. Grant Allen.*

> In the desert, with its monotonous sandy colouring, a black insect or a white insect, still more a red insect or a blue insect, would be immediately detected and devoured by its natural enemies, the birds and the lizards. But any greyish or yellowish insects would be less likely to attract attention at first sight, and would be overlooked as long as there were any more conspicuous individuals of their own kind about for the birds and lizards to feed on. Hence, in a very short time the desert would be depopulated of all but the greyest and yellowest insects; and among these the birds would pick out those which differed most markedly in hue and shade from the sand around them. But those which happened to vary most in the direction of a sandy or spotty colour would be most likely to survive, and to become the parents of future generations. Thus, in the course of long ages, all the insects which inhabit deserts have become sand-coloured, because the least sandy were perpetually picked out for destruction by their ever-watchful foes, while the most sandy escaped, and multiplied and replenished the earth with their own likes.

Thus, then, is explained the tawny colour of the larger animals that inhabit the desert; the stripes upon the tiger which, parallel with the vertical stems of bamboo, conceal him as he stealthily nears his prey, the brilliant green of tropical birds, the leaf-like form and colours of certain butterflies, the dried twig-like form of many caterpillars, the bark-like appearance of tree-frogs, the harmony of the ptarmigan's summer plumage with the lichen-coloured stones on which it sits, the dusky colour of creatures that haunt the night, the bluish transparency of animals which live on the surface of the sea, the gravel-like colour of flat fish that live at the bottom, and the gorgeous tints of those that swim among the coral reefs.

Among the secondary causes of modification of species Darwin gives prominence to "sexual selection," or the struggle between males for the possession of females, the result being that the stronger males secure mates and transmit the qualities which have given them the mastery to their

* "Origin of Species," sixth ed, p. 51.

* "Charles Darwin," p. 97.

offspring. Every farmyard combat between cocks illustrates the truth of Schiller's lines:

> Meanwhile, until philosophy
> Sustains the structure of the world,
> Her workings will be carried on
> By hunger and by love.

And among the larger animals—as stags and deer, and notably fur-seals*—the deadliest combats take place at certain seasons for possession of the females. But there is competition less fierce in character, if not less fatal, to the weaker or unendowed, strength giving place to grace of form, brightness of colour, and witchery of song, the females making choice of the male that attracts them most, or, as among the highest species, where he has wealth or good social position. These condone infirmity and ugliness.

Sexual selection thus explains the development of special features which, transmitted in increasing degree through a series of generations, have contributed to the survival of the fittest. For whatever these features may be, whether weapons of defence or attack, plumage and song of birds, colours of butterflies, perfume as of the musk-deer, or acrid taste as of the toad, their presence is explained by their utility, since, as with the flowers and scents wherewith plants attract insects to secure fertilisation, the primary function of colour, form, ornament, and whatever else has given advantage to plant or animal over its competitors is its service to the organism, and not, as man in his conceit has assumed, the delight or profit which it has given to him.

COAL.

By W. MATTIEU WILLIAMS.

ASSUMING that the seam is reached by the methods already described, that the roads are made for carrying it to the shaft, we now require to learn how the collier cuts up the seam into the portable lumps with which we are all familiar. The usual mode is by what he calls "holeing," which, if I am not mistaken, is another mining technicality of Scandinavian origin, as it is not by any means making a hole, but is undermining in order to overthrow, and *holfa* and *hvolfa* are Icelandic verbs signifying to turn over or overthrow.

The mode of holeing is to undermine the seam by cutting a groove along the lower part of the coal or the bed of rock that underlies it. This is made as narrow as possible to save labour and coal, and extends horizontally under the seam to a distance of two or three feet, as far as the collier can freely reach with his pick, which is made narrow and sharp for the purpose. The position of the worker when holeing is apparently very awkward and constrained. He lies on his side or squats sideways, and swings the pick horizontally, delivering several smart blows before he scrapes out the fragments he has made. In thin seams his position appears most painful, but he endures it patiently, without grumbling more than other men grumble at their daily labour.

In colliery districts where the prevailing seams are less than five or six feet thick, this mode of working, and the constant habit of accommodating the body to a low roof, has developed an interesting muscular modification. If the reader should be passing through such a district, he may distinguish a collier in repose from any other member of the population. His favourite position is to squat on his heels, leaning his back against a wall, just as he rests underground during the merry dinner hour. On a bright Sunday afternoon he squats in this queer attitude against the wall by the side of his cottage door, supremely happy in the enjoyment of his short pipe and the rare luxury of bathing in the sunbeams.

Thus undermined, the coal either breaks down by its own weight, or is thrown down by driving wedges into it a few feet apart by means of heavy hammers, or boring holes (this is *not* called holeing) with a drill and blasting with gunpowder.

Blasting with gunpowder is of course inadmissible where there is any liability to accumulation of fire-damp, but as the cutters are paid by piece-work, the temptation to adopt it is very great, because much more can be thrown down with a given amount of labour by blasting than by wedging. Thus is sometimes presented the anomaly of miners carrying safety lamps and blasting with gunpowder in the same working. Mr. Galloway has shown by a long series of careful investigations that the danger of blasting is by no means limited to pits or workings containing explosive gases. A working may be quite free from these and yet an explosion, with fatal consequences, may follow an ordinary blasting shot. This happens when there is much dry coal-dust accumulated in the immediate neighbourhood of the shot and extending far beyond. Each of the millions of minute particles takes fire by combining with the oxygen of the air, and fires its neighbour, the combined result being an evolution of a great volume of carbonic oxide and carbonic acid gases, and gaseous water, as well as a destructive outburst of flame; the expansion of the gases driving the flame along the workings with a force and velocity comparable, though inferior to, the generation and propulsion of ignited gunpowder gases through a gun.

Many substitutes for gunpowder have been proposed. One of the most promising is that of using the expansive energy of the chemical union of water with quicklime. When the hydrate (slaked lime) is thus formed a considerable increase of bulk occurs. By filling a bore-hole with lime instead of gunpowder, then tamping or plugging and admitting water by permeation, the expansion of the solid lime exerts a disruptive force like that of the expansion of the gases evolved by the combustion of the gunpowder.

Some seams are cut at the middle or top and wedged accordingly. There may be various reasons for this. Thus, in working the Flintshire cannel, which consists of two beds—the smooth cannel and the curly cannel—it was customary when I was there to hole into the top, and wedge up from the bottom, because the upper smooth cannel has a much smaller value than the curly below it, and is much softer than the bituminous shale which is below the curly cannel. That part which is cut away in the work of holeing is, of course, reduced to slack, and is of little value—so little that I have seen it freely used for ballasting railway sidings, being cheaper on the spot than gravel or stony soil.

A great deal of this slack is now utilised by making it into "patent fuel," *i.e.* blocks formed by conglomerating the fine fragments by means of pitch or tar or other binding material, aided by pressure, or even by great pressure alone. Square bricks or cubes as large as may be conveniently handled are thus formed, the value of which is well appreciated by those who have travelled far in steam-packets, and know the grimy horrors of ordinary coaling, as compared with the cleanly shipment of these blocks. Their compact stowage is a further great advantage.

It is evident that if the whole of a seam of coal were thus cut away and removed at random over a wide area, the rock above would fall in and bury the miners. The simplest

* Cf. Elliott's "An Arctic Province," ch. x, for a vivid account of the battles between the males for priority on the breeding-grounds of the Pribylov Islands.

and most obvious remedy for this is to cut away only a portion of the coal, leaving other portions standing to support the roof. This is the old and primitive method of working, which is still followed in many colliery districts. It is variously designated "pillar-and-stall," "post-and-stall," "bord-and-pillar," and in Scotland "stoop-and-room" working. There are various modifications of this mode of working, the technical details of which it would be tedious here to describe. The problem is by no means a simple one, the necessities of ventilation being imperative, as well as the economical and safe removal of the coal itself.

The simplest and commonest mode of pillar-and-stall working may be understood by comparing the proceedings to the laying-out of the ground-plan of a new American city, the coal which is first cut out corresponding, on a somewhat narrower scale, to the parallel main avenues and the side streets at right angles to them, the pillars of coal that are left behind corresponding to the houses between the streets. A current of air, amounting in some cases to a fresh breeze, is made, by means to be described hereafter, to traverse all these streets, though their united length may run into miles.

It is obvious that a large amount of coal remains as supporting pillars after all this street cutting is done. The pillars may amount to as much as three-fourths of the seam, and rarely if ever to less than one-third, modern progress tending rather to increase their dimensions as the pits are deeper. In some of the deep Newcastle pits they amount to as much as four-fifths: 30 to 40 yards long and 20 to 30 yards wide. As much as 40 yards by 40 yards are reached. These, of course, have to be finally removed more or less completely, and this removal or "robbing" of the pillars is a dangerous part of the miner's work. In pits where open candles are used in the primary workings, safety lamps are demanded for this. This demand, in such cases, is, I suspect, rather due to the coal dust than to the fire-damp, which is commonly credited with it.

The pillars are cut away one by one, and "juds" or wooden props are wedged into their places. This is continued until all the pillars of one compartment of the mine called a "panel" are removed. Then the juds are knocked away, the roof falls in, and the floor creeps up, forming a mass of ruins called a "goaf."

A panel is simply a space of some acres surrounded by thick walls of coal, to cut off free communication with the other parts of the mine. This prevents the mischief that has arisen from the accumulation of gas in the midst of the *débris* of the goaf of old workings. These panel walls are the last portions of the coal to be removed before the pit is finally abandoned.

The mode of robbing the pillars is either by driving a bord through them, and thus obtaining a good place for the supporting juds in the middle part of the original pillar, or by slicing them away from their faces. Much care and skill is required in the economical and effective placing of the supporting props, and of pack walls to protect the men from the falling roof.

A vast quantity of coal, the wasted pillars of older workings, remains hopelessly buried. In the older and cruder modes of working the pillars were left as small as possible, and finally they were crushed, the roof coming down and burying them. The greatest waste of this kind has occurred in the richest of all our coal seams, the 10-yard seam of South Staffordshire. The great height between the floor and the roof of this seam—25 to 36 feet—renders the use of juds or wooden pillars inapplicable for support, and also demands some peculiar modes of working generally, which are thus described by Mr. Warington W. Smyth: "Main workings or *sides of work* are opened in the form of a square or parallelogram, 50 yards in the side or more, and shut off by a rib of coal 7 or 8 yards thick, at the least, from all other workings, except at the entrance a narrow *bolt-hole*. Driving out in the lower coals, and gradually rising to the higher ones, the colliers open stalls of 5 to 8 or 10 yards wide, forward and across, so as to leave square pillars, generally 9 or 10 yards in the side, and whenever the unsoundness of the coal or roof appears to require it, sparing additional supports of coal in *men-of-war* 3 or 4 yards square."

Those who are so easily satisfied, as many are, concerning the prospective duration of our coal supply should ponder on the fact that this wonderful seam, on which was based our supremacy in iron making and most of the other industries dependent on coal, is now very nearly exhausted; only a small fraction remains, and that is but the portion which is the most difficult to work, and which consequently must become dearer and dearer as the difficulty increases.

It is quite true that we shall never exhaust our coal supplies, for the simple reason that there will always remain a great deal which cannot be worked; but we actually have exhausted, or have reached the verge of exhaustion of those fields which, by their exceptional richness, gave us our advantages over our neighbours, who have now much more coal than we have, though none so cheaply obtainable as that which we originally had, and which twenty years hence we shall have no longer. We shall still have plenty of coal then, but it will be quite as costly as the coal of France, Germany, Belgium, &c., and much more costly than that of America and China.

In my next I will describe *long-wall* working, which is more economical, and when properly conducted, safer than the methods above described.

GREAT CIRCLE SAILING.

By Richard A. Proctor.

MR. FROUDE in his "Oceana" touches from time to time on great circle sailing, or, in other words, on that method of directing their course at sea, by which the wiser seamen take the shortest course from port to port. He is not always strictly accurate in his remarks on this advantageous method of sailing, but he is always interesting; nor do the slight errors in matters of detail detract from the general accuracy of his statements. At the very outset of his ocean travelling, one day only from Plymouth, we find him observing that the *Australasia* was "outside the Bay of Biscay, far to the westward of our course as traced on a flat chart; but the captain tells us," he proceeds, "that we should see it to be right on a spherical one, and we entirely believed him." In reality the great circle course from Plymouth to Cape Verde passes but slightly to the west of the course traced on a Mercator's chart, which we assume to be what Mr. Froude means by a flat chart—at any rate, it is the only kind of flat chart used by seamen. Yet the principle is sound which underlies Mr. Froude's statement; and, slight though the advantage may be which a great circle course has over a rhumb course (the ruled line on a Mercator's chart), the difference of distance is worth saving. In the case of a sailing vessel, indeed, which against adverse winds may have to beat across the course which a steamship or a ship under fair winds would pursue, a very slight gain on the shortest course may result in a very considerable gain on the whole journey. Consider, for instance, the following statement in Professor Hughes's excellent little work on the construction of maps, a statement for the accuracy of which I can answer, having independently tested the matter: "In the case of a voyage from the mouth of the English Channel to New York, supposing a due west or adverse wind to last during the entire voyage, and presuming a ship to advance at the rate of 150 miles a day, the length of time occupied by her following throughout the tack nearest to the rhumb course (or that which would be pursued in the ordinary practice of navigation) would be forty-nine days, while by pursuing the tack nearest to the great circle course, the time would be diminished to forty-three days eight hours—the distance passed over being in the former case 7,361 miles, and in the latter 6,488 miles, a difference of 873 miles in favour of the great circle course."

It may surprise the reader perhaps to learn that, in such a journey as Professor Hughes has here considered, the "practical" seaman of the old school, who refuses to be troubled by "great circle nonsense," and sticks to his rule of thumb rhumb rules, will on certain parts of his course be actually increasing his distance from his port, by sailing as close as he can to the rhumb track pencilled on his chart. For example, suppose him off the Lizard; his rhumb course for New York, a straight line on Mercator's chart, would lie west-south-west; his shortest or great circle course would lie about west by north. Suppose now that the wind is about west-south-west, and that the ship cannot sail nearer than six points to the wind, then the proper course to pursue is to make long tacks to the north-west, only three points from the true great circle course, and short tacks to the south, in which a certain amount of distance is lost. But the practical old sea-dog who sticks to his rhumb line will take equally long legs to the north-west and to the south, supposing each to be about six points from his true course, whereas on every southern tack he is nine points from his true course to New York and only seven points from his true course *home*. Such is the practical effect of too strong a hatred of new-fangled ideas.

Mr. Froude remarks of the seeming departure of the *Australasia* from the straight-line track on the chart that, had the passengers been required to give their independent opinions, they would have voted "that we were going wrong, and must change our direction, especially if they suspected that the captain and officers were interested in the matter. They were not asked for their opinions, and did not wish to give them. They were contented, being ignorant, to be guided by those whom they supposed to know," on which he makes the rather odd comment, "This is the universal rule, and when it is observed our sums work out clear without fractional remainders."

This trust in the superior knowledge of the officers who direct a ship along the shortest route is especially taxed when long journeys have to be taken in high latitudes. For instance, imagine the state of mind of a passenger who, having opened his Mercator's map, had traced out thereon the track from Cape Agulhas to Melbourne, and found, at the end of the first day out, that the captain was taking the ship to the south-east instead of nearly due east as the map seemed to indicate. If perchance the passenger were a flat-earth man, and had provided himself with one of those ingenious maps in which Mr. Hampden (following the deceased Newton of the flat-earth folk, "Parallax"), presents the earth in cart-wheel form with the north pole as its centre, and the south polar regions around its circumference, the case would be even worse. For, drawing a straight line from the Cape to Melbourne on such a chart, the unhappy paradoxist passenger would recognise as the shortest track to Melbourne a course running considerably north of east, and the perversity of the captain in running considerably south of east would seem still more disastrously mistaken.

It may be imagined how far the shortest or great circle course may be from any such track as a chart would show as such, that if one were starting from England to China on a great circle course one would go neither to the east nor to the west, but nearly due north. So if one were starting from Cape Town to New Zealand, one would go neither east nor west, but nearly due south.

As a matter of fact, the actual great circle course in such cases cannot be pursued. The assaults made in former times on the problem of the north-western passage probably involved some perception of the fact that an Arctic journey, if practicable, was the best way to reach India; though a north-eastern passage, such as Nordenskjöld has accomplished, would be better than a north-western one, if both were not so difficult and dangerous as to be utterly useless, at least as ways to the Pacific Ocean. But even such moderate approach to the Antarctic regions as many journeys in the Southern Ocean would involve, if made along the great circle course, is in reality so undesirable that it may be regarded as to all intents and purposes forbidden by nature. Consider, for example, the following cases of icebergs seen in latitudes not nearly so high as those into which the great circle course from Cape Town to Adelaide or to Melbourne would carry a ship. They are cited by Mr. Towson in a paper on the Icebergs of the Southern Ocean, published by the Board of Trade:

On September 10, 1866, the *Lightning*, when in latitude 55° 33′ south, longitude 140 west, came across an iceberg 420 feet high.

In February 1850 Captain Clark, of the same clipper, records an iceberg 500 feet high and *three miles long*, seen in latitude 55° 20′ south, longitude 122° 45′ west.

On December 1, 1859, Captain Smithers, of the *Edmond*, reported *an island* 580 feet high and from two and a half to three miles long, in latitude 50° 52′ south, longitude 43° 58′ west. This island has not been admitted into the Admiralty charts, like some I know of, which for a time did duty there, but were discountenanced later. And there can be very little doubt that Captain Smithers's supposed island was merely an iceberg of enormous size. Probably the Antarctic tract recorded by Captain Wilkes, of Trent notoriety, and subsequently sailed over by an English ship, was a still more enormous field of floating ice, many miles in length, and averaging nearly a mile in total thickness.

In January 1861, five icebergs, one 500 feet high, were met with in latitude 55° 46′ south, longitude 155° 56′ west.

In the same month, 26′ farther south, and 4° 4′ farther west, an iceberg 500 feet high and half a mile long was found.

In April 1864, the *Royal Standard* came into collision with an iceberg 600 feet in height.

In December 1856, four large icebergs, one of them 700 feet high and another 500 feet, were met with in latitude 50° 14′ south, longitude 42° 54′ east.

On Christmas Day 1861, pretty near Midsummer Day, too, in the southern hemisphere, the *Queen of Nations* fell in with an iceberg in latitude 53° 45′ south (corresponding to the latitude of Hull or Leeds in our northern hemisphere), 720 feet high. This was in longitude 170° west.

On March 23, 1855, the *Agneta* passed an iceberg in latitude 53° 14′ south, longitude 14° 41′ east, 960 feet in height.

On August 16, 1840, the Dutch ship *General Baron von Green* passed an iceberg 1,000 feet high, in latitude 37° 22′ south (corresponding to the latitude of Seville in the north), and longitude 14° 10′ east.

Lastly, on May 15, 1859, the *Roseworth* found in latitude 53° 40′ south, longitude 123° 17′ west, an iceberg as large as Tristan d'Acunha.

When we remember that the iceberg seen by the *Agneta* must have been upwards of a mile and three-quarters thick, we see what amazing masses of ice come forth from the Antarctic regions, and how unsafe it would be for seamen to pursue too scrupulously the great circle course on long voyages in the Southern Seas, seeing that such voyages, if pursued, would carry them into regions where ice masses even more portentous than those described would be crowded in even greater profusion.

Yet, are there no seas where, so far at any rate as eastwardly voyages are concerned, the great circle course seems more inviting than in the southern portions of the great Indian Ocean? For there within the "roaring forties," and even far to the south of them, the mighty west winds blow which raise the greatest waves which are known in our world. "Between latitude 40° and the ice of the South Pole," says the latest account published of these western winds, "a steady draught of air from the west blows perennially all through the year and all round the globe. It may shift a point or two to north of west, or south, but west it always is; never sinking below what we call a stiff breeze, and rising often to a gale or half a gale; and constantly, therefore, there is a heavy sea, nearly a thousand miles broad, rolling around the earth from west to east. The waves were magnificent," proceeds Mr. Froude in "Oceana"; "I believe the highest ever fallen in with are in these latitudes. Vessels for Australia under sail alone accomplish often three hundred miles a day on the course on which we were going. If they are bound west they keep within the tropics, where these winds do not reach. To steam in their teeth would be impossible even for the most powerful ships afloat."

Indeed so moved was Mr. Froude by the impressive picture presented by this zone of fierce west winds, urging the waters of the sea ever eastwards over the broad span of one thousand miles swept by their strong breath, that he was led to propound what on a later page he calls his own wave-theory depending on this phenomenon. I venture to digress for a moment to touch on this theory of Mr. Froude's, which, as it proved inviting to him, might be attractive to others, though based in reality on a singular misapprehension of mechanical laws.

The reader is doubtless aware that, owing to a certain acceleration, or apparent acceleration, of the moon's motion, beyond what the law of gravitation seems capable of explaining, astronomers have been led to entertain the belief that our earth's rotation, the clock by which we measure astronomical time, may be running gradually slower and slower century after century. The case may be compared to that of an apparent acceleration in the speed of a racer, equine or human, timed by a watch not thoroughly trustworthy; if such a watch were running slow, the timer might very well believe that the racer had gained more in speed than he really had—though perhaps a part of the observed difference might really be due to an increased velocity. To account for that portion of the moon's increased speed which could not be accounted for by gravity, a very slight diminution of the earth's rotation would be required, corresponding to the loss of much less than a second of time by our terrestrial clock in one year. It has been supposed that the whole difference may be explained by the action of the tidal wave in a direction contrary to that of the earth's rotation spin. The French mathematician, Delaunay, showed, in fact, by a calculation of great profundity, that the tidal wave raised by forces exerted on the earth from without must produce some effect on the earth's rotation. Airy, who at first doubted this, subsequently admitted the validity of Delaunay's reasoning; and the influence of the tidal wave in retarding the earth's rotation may be regarded as proved.* But it has become very doubtful whether any retardation actually takes place, and it is now generally supposed that the retarding influence of the tidal wave may be counterbalanced by some other causes, as yet not definitely determined, by which the earth's rotation may be hastened. Thus the earth's globe may be shrinking in sufficient degree to have its rotation thereby hastened as much as it is being retarded through the constantly westwardly motion of the tidal wave. Or there may be other accelerative causes. And just here Mr. Froude steps in with his own wave-theory. It struck him, he said, after describing the waves carried so steadily eastward by the mighty winds in the South Indian Ocean, that "a series of enormous waves for ever moving in one direction over so large a part of the earth's surface, might in some degree counteract the force which is slowly stopping the rotation of our planet. . . . These great waves in the Southern Ocean for ever moving in the opposite direction to the tidal wave, may at least so far counteract it as to add a few million years to the period during which the earth will be habitable."

But, alas! the answer to this is akin to the answer which George Stephenson made to the paradoxist who wished to enforce his own theory of perpetual motion. "All right," said the great engineer, "but before you demonstrate your theory, oblige me by doing what must be very easy to you if you can secure perpetual motion; take yourself up by the waist-band and carry yourself round this room; then I will listen to you—with pleasure." The earth is the weight to be rotated, the west winds are the force by which she is to be moved, and the thousand-miles wide zone of the Southern Ocean is as the waist-band by which she is to be carried round. Unfortunately, though the sun's heat by which winds are raised is an external force, all the mechanical action of winds is earth-born; for every breath of wind moving northwards there must somewhere be as much moving with equal force southwards; for every breath of westerly wind an equal force of easterly wind must somewhere be exerted. No balance whatever, in one direction or in another, can remain outstanding; for the law of motion discovered by Newton is not that action and reaction are pretty nearly equal, but that they absolutely and exactly counterbalance each other. The action of the winds is by no means like that of the tidal wave, where the mechanical forces at work have been called into action by the sun and moon, bodies acting on the earth from without.

These western winds in the southern seas, however, though they do not effectively fan the rotating earth, make the great circle track most advantageous for the seaman travelling towards the east. From Cape Town to Melbourne along a great circle course, the distance amounts to $5{,}566\frac{5}{6}$ geographical miles, whereas the distance on a rhumb line is no less than 6,154 geographical miles, or 587 knots farther. Nearly the whole journey would be favoured by strong westerly winds. An ordinary sailing

* Mr. Ellery, Government astronomer at Melbourne, expressed, I see, the opinion—in conversation with Mr. Froude—that the retarding influence of the tidal wave is not proved. But however skilful Mr. Ellery may have shown himself as head of an observatory, I have not heard of any studies he has pursued, or any investigations he has published, which would make his opinion of weight on a mathematical question of this kind, especially where two of the greatest masters of the mathematics of astronomy have been led, after a thorough examination of the evidence, to regard as demonstrated that which Mr. Ellery rejects as still unproved. In such cases, "unproved for me" would be the more accurate way of expressing doubt.

vessel would gain not a few days only, but weeks, by following the great circle track, supposing no icebergs intervened, and that no storms arose in high southern latitudes which, even though blowing in the right direction, would be too fierce for ordinary sailing, or might even dismast and disable the stoutest sea craft.

Even the most favourable great circle course, then, may have to be modified in order to secure safety, which must be the first consideration with all prudent ship-captains and with all wise shipowners. For instance, the great circle course from Cape Town to Melbourne would carry a ship into about 58° south latitude, as would also a great circle course round Tierra del Fuego to Cape Town. A course from Dunedin to Valparaiso would pass into still higher latitudes. These journeys would all be very dangerous, a large portion of each being infested by icebergs, and exposed also to storms so terrible that the stoutest clipper could not hope to pass through them with unclipped wings. It would ill-profit a captain to have shortened his journey a hundred miles or so, or even to have secured favourable winds throughout the whole of it, if half the journey had to be made under jury rigging, and a large sum had to be expended to restore the battered bulwarks, and replace the best sails torn from the bolt ropes by the hurricanes of the southern seas. The risk of actual loss through collision with an iceberg, or by foundering in some great storm, is great enough to be an important consideration to the bravest masters, and if not to all shipowners, to the wiser, and assuredly to all underwriters.

It is necessary, then, to follow a course designed to combine the greatest possible advantage in regard to distance and favourable winds with the least risk from icebergs and storm. This is done by following what is called the composite course. Supposing, for example, a captain or shipowner decides that on the journey from Cape Town to Melbourne no latitude higher than 50° south shall be touched, then the plan to be pursued is to travel on a great circle course from Cape Town to touch the limiting latitude parallel, and thence to travel along that parallel until the point is reached where a great circle course from Melbourne to that latitude parallel would touch it. This was the course pursued by the captain of the *Australasia*. Mr. Froude, after mistakenly remarking that the true great circle course from Cape Town to Adelaide would lie athwart the South Pole proceeds: "This way there is no passage; we were to keep within the 'roaring forties;'" and even so, though it was the southern midsummer, and the nights but two hours long, they had to prepare for the temperature of an English winter. "The thick clothes must come out of our boxes again," he says; "the fire will be relighted in the saloon; we may fall in with icebergs, and see snow upon our decks, and then in three weeks we shall be again in tropical sunshine amidst grapes and flowers."

Here, however, I must correct a rather curious mistake which appears in one or two treatises on navigation. It is asserted that the shortest way of passing from any one place to any other on the earth's surface, subject to the condition that the track shall nowhere pass above a given latitude, is not the composite course, but two great circle courses meeting on that point of the highest latitude parallel, which has the same longitude as the point of highest latitude on the actual great circle course. For instance, the most southerly point on the true great circle course from Cape Town to Melbourne lies in longitude 84° east and latitude 58° south; the composite course touches latitude 50° south about $72\frac{1}{2}$° east, and leaves it about 98° east! Now, the idea which I describe as a "curious mistake" consists in supposing that a better course than the composite one would be to run great circle-wise from Cape Town to latitude 50° longitude 84° east, and thence also on a great circle to Melbourne. This journey, compounded of two great circle courses, would unquestionably be shorter than the composite course compounded of two great circle courses and one course along a parallel. But it would carry the ship *twice* outside the limiting latitude—viz., for a considerable distance on the west of the point where the two great circle courses meet, and for a still greater distance on the east of that point.

Recognising the advantages of great circle sailing—(1) in its simplest form where practicable; (2) in the composite course where a simple great circle course passes through inconveniently high latitudes; and (3) as judiciously combined with due consideration of winds and currents, the question naturally arises, Why do not all sea-captains seek to obtain to the fullest possible extent the advantages which this method of sailing offers? Shipowners ought to be even readier to adopt the principle of great circle sailing, since its employment would diminish not only the length of ocean journeys, but also sea risks and expenses.

It need hardly be said that captains who are navigators as well not only recognise the advantages of great circle sailing, but avail themselves also of those advantages. But it must be remembered that a large proportion of the masters of ships engaged in trade are unable to employ any but the simplest methods of navigation. Accustomed to rhumb sailing, they are not very willing to employ methods which require either complicated constructions or more or less recondite calculations. I use the word "recondite" rather than "difficult," because the former word corresponds with the real objection which many skippers entertain against processes of calculation. If a shipmaster knows that taking out certain numbers from tables, and dealing with them according to certain formulæ, he will get out his proper course at starting from any point to reach a given port, he yet has the feeling that in adopting the course so calculated he is, as it were, walking in the dark. A wrong figure or a wrong sign, or some misunderstood direction, might have made the calculation work out wrong, and the course on which, confiding in it, he sets out *may* therefore be very far from the best.

Thus, although Mr. Towson has provided a series of admirable tables for facilitating the practice of great circle sailing and composite sailing, it is found that a large proportion of the captains of ocean-going vessels care little to avail themselves of these tables. Steamers may follow a particular calculated track—though there are few steamers as compared with sailing ships or auxiliary steamships on the longer voyages to which the principles of great circle sailing chiefly apply. But sailing vessels are often driven far from the course which might be calculated, at starting, as the best; and once this has happened the calculations so made are practically useless.

On the other hand, Mercator's charts are so simple and a rhumb line is so easily drawn, being simply a straight line, that seamen are not greatly attracted to the use of methods requiring complicated constructions to obtain the required course, or showing that course in a way not easily interpreted. For we must remember what the sailor wants, and what, so far as the rhumb course is concerned, Mercator's charts actually supply. He wants not only to know through what latitudes and longitudes his voyage will carry him, but to know at each point of his journey the bearing of his course. Suppose, for instance, he has been driven off the track he had intended to follow, and finds himself in a certain position, he marks that position on his chart, and joins the point by a straight line with the place of his port as marked on the chart. This line shows him at once what course to pursue, for it crosses the meridians (or north and south lines) on his chart at precisely the angle at which the course he is to steer should be inclined to the north and south line through the ship. He can measure the angle on his map at once, without any construction for correcting it in any way; and then he can direct his course on the sea accordingly by the compass in the customary way, making only the usual correction for the deviation of the needle.

But now, suppose our skipper wishes to use some chart for great circle sailing. If he takes his usual sailing charts, he can only obtain the great circle course by a complicated construction, the actual curve which in a Mercator's chart represents a great circle course on the earth belonging to a class of curves whose properties can only be treated by the higher mathematics. Sir George Airy calculated a table, long ago, which was intended to facilitate the construction of approximate great circle courses on Mercator's charts; but to the use of this table the same objections apply as to the use of Towson's tables for calculating the whole course.

Is there, however, no form of chart by which the great circle course may be drawn, as in Mercator's charts the seaman draws the rhumb course, as a straight line? There is the Gnomonic Projection, by which this may be done; and if the seaman could turn to a gnomonic map containing his port of departure—or his position at any given moment —and his haven, all he would have to do in order to determine his proper track would be to draw a straight line from one point to the other.

But there are two very serious objections to the use of gnomonic charts. In the first place no gnomonic chart can conveniently show more than a small portion of the surface of the globe—for the scale increases enormously as the distance from the centre of the map increases. How enormous the scale becomes, far beyond the limits to which many projections can be carried, will be inferred from this, that to show a hemisphere on this projection a sheet of infinite size would be required. (Charts of infinite size are not approved of on board ship; they would be inconvenient even on the *Great Eastern*.) But apart from this objection, which is in reality fatal against the projection, there is another, which would suffice to make the course drawn on a gnomonic chart unmeaning and therefore useless to the seaman. All the angles at which the course is marked so simply on a gnomonic map are different from the real corresponding angles on the globe itself. For the shapes of all the spaces on a gnomonic chart are distorted, in varying degree, according to their distance from the centre of the chart. Since the essential object of a seaman's chart is to show him his bearings, this objection is altogether decisive, and accordingly gnomonic maps have not come into use for nautical purposes.

There is, however, another projection which, so far as I have learned, has never yet been used by seamen, which possesses advantages as great in relation to modern nautical requirements as Mercator's projection presented for the comparatively rough requirements of Mercator's time—or even for much later times when, according to Commander Maury, a seaman shaped his course from England to Boston so roughly as to be well content if he fetched up at New York instead. According to the plan which I thus propose for a nautical chart, which may either be used alone or in conjunction with a Mercator's chart, a chart can conveniently show the whole globe except either the Arctic or the Antarctic regions, according as the south pole or the north pole is made the centre of the map. The great circle course from any one point to any other point appears as the arc of a circle, the only feature in which the projection is less simple with reference to great circle sailing than Mercator's is for rhumb courses. (Though indeed a geometrician might be disposed to say that in this respect the proposed charts have the advantage, since in a geometrical sense it is much easier to describe a circle correctly than a straight line.) However, this is saying little until it is shown further how this circular arc is to be drawn. For instance, quite a complicated construction might be necessary to determine the centre and the size of the circle required. Here, then, is the construction, so simple that a schoolboy often could deal with it correctly. Describe a circle through the ship's place, the desired haven, and the antipodes of either point on the chart; this may be done without the trouble of any construction, simply by feeling about with a pair of compasses till the right centre and opening are found. But if construction be preferred, then the simple method given in Euclid, Book IV., for circumscribing a given triangle may be employed. This, however, is really useless, seeing that in twenty seconds the trial method will give all that is wanted, whereas construction may require perhaps a couple of minutes for an unpractised hand, or a minute or half a minute for one which is skilful in such work.

But the chief advantage of this new nautical chart has still to be mentioned. In regard to bearings, it has precisely the same qualities as Mercator's chart. All bearings are correctly presented; or, in other words, the circular arc, pencilled from point to point, cuts all the meridians at exactly the right angle, that at which the seaman's course must intersect the north and south lines on the globe when he is pursuing the shortest or great circle course.

It may be asked, however, how the new chart will lend itself to composite sailing, which, as we have seen, is often a necessity. It does so perfectly. The problem is to describe a circular arc which shall pass through the seaman's place, port, or haven, and shall touch a given parallel of latitude. All parallels of latitude are concentric circles on the chart. Suppose the parallel to be touched is that of 50° south latitude; then all that is necessary is to describe a circle on the chart, which shall pass through the seaman's place or haven, and touch *on the inside* the circle representing 50° south latitude, while it touches *on the outside* the circle representing 50° north latitude. Nothing can be easier, because the last two conditions manifestly determine the size of the required circle. For any one who will draw two concentric circles on a plane will find that to touch the outer one on the inside, and the inner one on the outside, a circle must have a radius midway in length between the radii of the two circles. The centre of the required circular arc lies on a given latitude parallel in the chart; and it need hardly be said that to describe an arc of given radius through a given point, and having its centre on a given arc, is child's play.

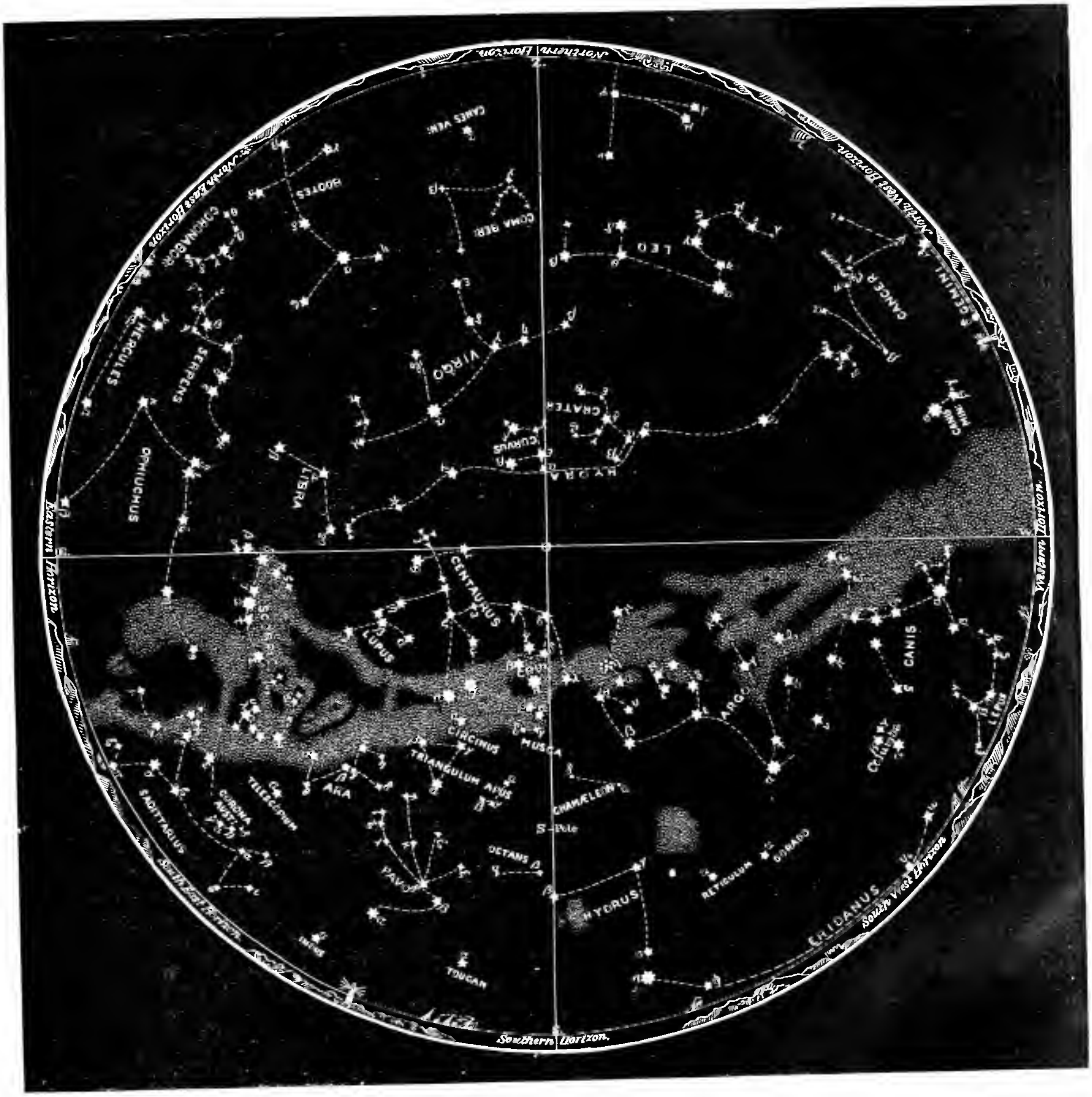
The drawing of the great circle course, or the composite course, as may be required, is the work of a minute or two at the outside. The interpretation of every point of the course thus determined is precisely the same as in a Mercator's chart. If the seaman has been beaten off his track, he can describe the shortest course from his new position as readily as he could describe the rhumb course on a Mercator's chart and interpret it as simply.

I venture then to express with confidence my belief that the new great circle sailing charts may serve the same purpose for seamen that Mercator's chart served in former times—saving much time, considerable expense, and many lives. For further information I may say with Mrs. Grudden, "see small handbills"—that is to say, consider the pamphlet accompanying the charts as issued by Mr. Stanford.

THE SOUTHERN SKIES FOR APRIL.

THE map showing the southern skies this month is to be interpreted as the maps which appeared in the December and January numbers were interpreted. As I have not yet received any proofs of the set of maps, completed to the end of the year, and write away from home, I am unable to consider the details separately. But as, in point of fact, the maps speak for themselves, this is a matter of small importance.

MAP V.—For February, March and April.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 16° TO 21° S.)
AND THE
SOUTHERN HALF OF OUR NORTHERN SKIES (UPPER HALF OF THE MAP) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, March 8.
„ 12.30 „ „ March 16
„ Midnight, March 23.
„ 11.30 o'clock, night, March 30.

At 11 o'clock, April 7
„ 10.30 „ April 15.
„ 10 „ April 22
„ 9.30 „ April 29.

At 9 o'clock, May 7.
„ 8.30 „ May 15.
„ 8 „ May 22
„ 7.30 „ May 29.

MAP II.

by Richd A Proctor.

THE ONE-SCALE ATLAS.

WE give another map of this series, reserving an account of the method in which the sphere has been divided, and each map projected, till our space is less crowded.

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

FEW spectacles are more beautiful and few more wonderful than to see the formation of crystals either on the stage of the microscope or with suitable materials on a magic-lantern slide. In a former article the exhibition of a silver tree in its rapid process of development was especially recommended. In this case a drop of solution of silver nitrate is placed on a slide, with the stage of the instrument horizontal. This plan—except when Stephenson's binocular is employed—is a little awkward with a tall microscope, as the tube is upright, but no other arrangement answers so well. A very small bit of copper, cut from the top of a wire, is put into the solution drop, after the latter has been focussed with an inch power. The chemical action is very rapid if the particle of copper is quite clear. Instantly a tree-like form springs forth, and the branchlets extend in all directions as if a living force impelled their growth. Each twig of the silver tree is seen to be made up of small crystalline particles, but the still minuter particles composing them are not discerned. The little silver crystals that unite to imitate the pattern of a plant are too thick to be translucent, as silver leaf is, and should be viewed under strong reflected light.

If we take another substance—say, tartaric acid, which crystallises very quickly from its concentrated solution—we see much the same process as with the silver solution, but the pattern is quite changed. Silver crystallises in octohedrons, and the native crystals often aggregate into thread-like and arborescent patterns, as in the microscope experiment. Tartaric acid crystallises in complicated patterns, which appear to be modifications of a rhombic prism. The tendency to complication makes it especially beautiful for microscopic exhibition, and its development should be watched under polarised light, which gives splendid colours. Even if the process is watched under a high power, the eye gains no vision of minute particles coalescing to make up any portion of the pattern. Each pattern visibly grows, and very fast, if the experiment is performed in a warm room and evaporation is rapid, but exactly how it grows is not made clear.

If, therefore, we want to see a little more of the way in which non-crystalline particles adhere to form crystals, we must select some substance that can be made to work in a manner and at a pace adapted to satisfy our curiosity. This was accomplished a few years ago by a German philosopher named Vögelsang. He thinned a little Canada balsam with bisulphide of carbon, which readily dissolves it, and in another small vessel dissolved a little bit of sulphur in the same fluid. Two half-dram tube bottles answer very well for the experiment. Two or three drops of the balsam in the state in which it is usually supplied, and about as much carbon bisulphide, will probably answer, but the amount of thinning the balsam requires must be learnt by a little practice; and it should be remembered that in thinning Canada balsam with any of its best solvents, the transition from being too thick to becoming too thin is very sudden after a certain point of dilution has been reached. A bit of brimstone the size of a peppercorn crushed into powder dissolves quickly in three or four times its bulk of the bisulphide.

Having prepared the two solutions, take a small glass rod, or, what will answer, two lucifer-match sticks. Use one for the balsam and one for the sulphur solution, or if the glass rod is employed clean it each time with a little benzine and a rag, so as not to get any sulphur into the balsam bottle. Put a small drop of the balsam on to a glass slide with the microscope stage horizontal, that it may rest quite still. Then, having focussed it with an inch or half-inch power, add to the balsam drop one of the sulphur solution. Bisulphide of carbon evaporates very quickly, and the crystallisation process begins at once. Now, if the balsam is of the right stickiness, it retards this process sufficiently to enable its stages to be seen. First comes the formation of a swarm of what Vögelsang calls *globulites*: tiny spherules, such as are formed by precipitation of a colloid substance, like mastic, when its alcoholic solution is thrown into water. These globulites are not like solid particles of the sulphur; they are plastic bodies, and build up crystalline forms of exquisite beauty, which should be viewed in various ways—with transmitted, and reflected, and with polarised light. The sulphur precipitated in this way acts upon polarised light in proportion to its advance in crystalline development. The globulites that have not begun to make crystals do not show any colours, while the most complete crystals are in a brilliant blaze of prismatic hues.

These experiments of Vögelsang are scarcely known in this country except to the few students of micropetrology, although making sulphur crystals for the polariscope has not been uncommon. It is probable, as Vögelsang considered, that when the chemical molecules of any substance are precipitated from solution and form crystals, the first stage of the process is their aggregation into globulites, which in many cases require high powers of the microscope to discern, and in others escape vision, either from the rapidity of the process or from their optical properties.

In forming Max-Schulze's artificial diatoms by a method explained in a former paper, we obtain globulites of silica which have enough plasticity to unite in vesicles like very thin glass bulbs. The process consists in putting a spoonful of powdered fluor spar, and one of fine silicious sand or powdered glass, into a common 6 or 8-oz. wide-mouthed bottle, pouring sulphuric acid over it, and lightly stopping the mouth with a loose flock of cotton wool saturated with water. It is well to let the apparatus rest for four-and-twenty hours, and then delicately remove the vesicles from the cotton threads, and wash all the acid out of them. They are then fit for the microscope.

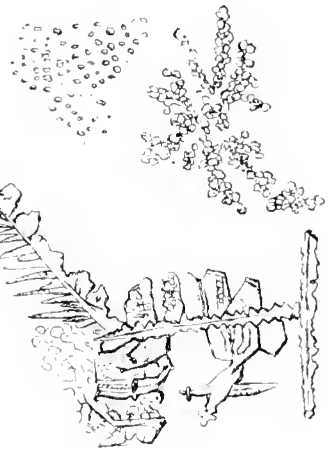
The writer many years ago obtained exceedingly fine silica films by passing silicic fluoride gas through glycerine four parts to water one part. Here the adhesion of the globulites is feeble, and the slightest touch broke the films. Lately another experiment was tried, with interesting results.

If the silicic fluoride gas is given off pretty quickly, which it will be if the bottle containing the preparation is kept warm in a water bath, the cotton is soon saturated with the fluosilicic acid and its fibre encased in silica. The cotton should be allowed to dry, and then small tufts lightly taken up with forceps and calcined in the flame of a spirit lamp in a platina capsule or spoon, or in a little Berlin crucible that will stand the heat. The capsule is the best, as the porcelain crucible will most likely be broken in inexperienced hands. For the water-bath mentioned above, take a round enamelled iron soap-dish, worth about sixpence.

If the cotton is well calcined, and moved carefully, the result is to obtain a sort of artificial fossil cast of the fibres, in the form of a number of hollow silica tubes, each built of innumerable globulites. They should be viewed with both transmitted and reflected light, and present very beautiful as well as curious appearances.

Instead of cotton fibre, pieces of wet sponge may be employed and calcined as before. A platina capsule about the diameter of a threepenny piece is big enough for these experiments, and can be obtained of the chemical apparatus sellers for a small price. To hold it, make a wire clip about six inches long, and stick one end in the cork.

The figures below are copied from Vögelsang and represent the sulphur globules and crystals.



SOLUTIONS OF PUZZLES.

PUZZLE XIX. *To find the square sections of a tetrahedron; and to fill a square hole with a tetrahedral plug.*

First, let ABCD, fig. 1, be a tetrahedron; E, F, H, K, L, M, the bisections of its six equal edges. Then LFKH is a square; for LF and HK, being each parallel to BC, are parallel to each other, as are HL and KF. Also HL, LF, FK, and KH are all equal, each being half an edge of the tetrahedron. Therefore HF is a rhombus. But by symmetry the angle KFL=the angle FLH; and HL being parallel to KF, these angles are together

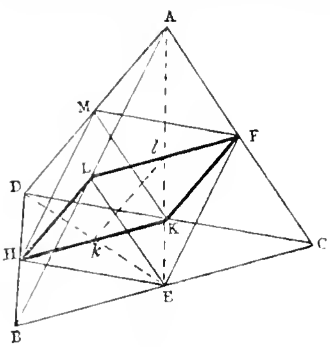


Fig. 1.

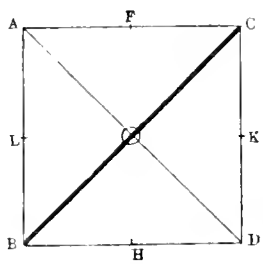


Fig. 2.

equal to two right angles; each therefore is a right angle. Therefore HLKF is a square. So also MFEH and ELMK are squares.

Note.—If the student does not feel the force of the argument from symmetry, he may for his own satisfaction prove LFKH a square, as follows: join AE, DE, cutting LF, HK in l and k respectively. Then BE being perpendicular both to AE and DE, is perpendicular to AED; so therefore are HK and LF perpendicular to AEF, for they are both parallel to BC. Also Ll=Hk, being the halves of equals. Hence LH is parallel to lk, and the angles lLH and kHL are right angles.

Secondly, to fill the square hole ABDC, fig. 2, with a tetrahedral plug. The figure shows the tetrahedron of fig. 1 fitted into the hole ABDC; ABC, BCD of fig. 2 being the faces so lettered in fig. 1, and ABD, DAC of fig. 2 being the other faces so lettered in fig. 1, supposed to be seen through the tetrahedron. The bi-sections of AB, BD, DC, CA are similarly lettered in both figures, while M and E of fig. 1 are brought into coincidence at O in fig. 2.

PUZZLE XX. *To find the regular hexagonal sections of a cube; and to fill a hexagonal hole with a cubical plug.*

First, let AG, fig. 3, be a cube; K, L, M, N the bi-sections of the edges AB, BC, AE, and EH. It is clear that if KL be produced each way, it will meet DA and DC produced in points P, Q, such that AP=AK=LC=CQ. So MN produced will pass through P, and meet DH produced in R, such that HR=HN=MA=AP. And obviously RQ will bisect HG, GC in S and T. Hence the plane of the equilateral triangle PQR gives the section required. For, joining MK, NS, LT, and noting that the points K, L, T, S, N, and M are the trisections of the sides

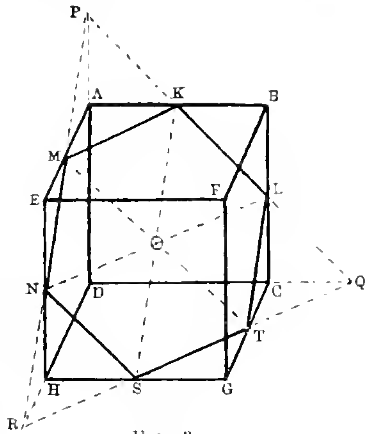


Fig. 3.

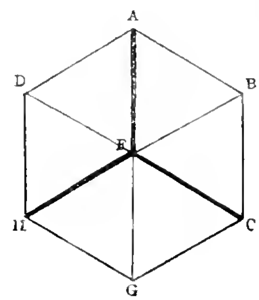


Fig. 4.

of an equilateral triangle, we see that LKMNST is a regular hexagon, from the well-known obvious properties of equilateral triangles.

And obviously there are four such hexagonal sections, which may be obtained by completing the square inscribed in ABCD, of which KL is a side and the construction as above.

Secondly, to fill the hexagonal hole ABCGHD with a cubical plug. The figure shows the cube of fig. 3 fitted into the hole ABCGHD; FA, FC, FH on the near side being the edges so lettered in fig. 3, and FB, FG, FD, supposed to be seen through the cube, are also the same as the edges similarly lettered in fig. 3.

PUZZLE XXI. *To find the regular hexagonal sections of an octahedron, and to fill a hexagonal hole with an octahedral plug.*

First, let ABCDEF, fig. 5, be an octahedron; G, H, the bisection of the opposite edges AD, BC; KL, NM respectively

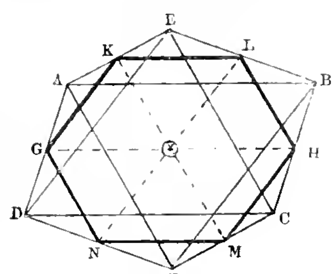


Fig. 5.

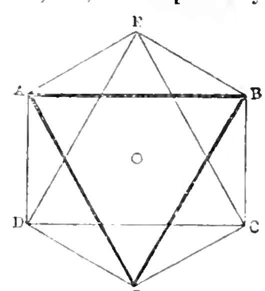


Fig. 6.

parallel to AB and DC, and bisecting the sides AE, EB, FD, FC. Then KL, GH, and NM are parallel and in the same plane (since a plane through GH, if it pass through KL, must by symmetry pass through XM also). Join KG, LH, XG, and MH. Then the six sides of the figure, KLHMXG, are all equal, being each equal to half an edge of the octahedron. Moreover, GH, KM, and LX bisect each other in O, by symmetry; and OG, OK, OL, OH, OM, and OX are all equal, being each equal to half an edge of the octahedron. Hence G, K, L, H, M, X are on the circumference of a circle about O as centre, and therefore the equal-sided figure GKLHMX is a regular hexagon.

And obviously there are four such hexagonal sections, each section passing through the centre O of the octahedron, and being parallel to two opposite faces.

Secondly, to fill the hexagonal hole AEBCFD with an octahedral plug. The figure shows the octahedron of fig. 5, fitted into the hole AEBCFD; the letters corresponding in the two figures as in each of the two former cases.

OUR PUZZLES.

THE puzzles which suggest themselves for this month are the following:

Noting that space can be occupied by a series of equal cubes, which if originally arranged in layers, and each layer in rows, can be shifted in layers and rows:

PUZZLE XXII. *Show how to fill space with equal tetrahedrons and square-based pyramids, having their triangular faces equal to those of the tetrahedrons; and determine the movements which can take place among the solids so filling space, without leaving any spaces vacant.*

PUZZLE XXIII. *Show how to fill space with equal tetrahedrons and with equal octahedrons, having their triangular faces equal to those of the tetrahedrons; and determine movements as in Puzzle XXII.*

PUZZLE XXIV. *Find a solid, having all its faces equal (not, however, one of the regular solids, whose faces are all regular figures), such that space may be filled by equal solids of the kind, no displacements being possible without leaving vacant spaces.*

Those readers who do not care to attack these puzzles in the general form here presented, may take instead the following easier problems:

PUZZLE XXII. *Arrange four equal regular tetrahedrons, and six equal square-based pyramids having equilateral triangular faces equal to those of the tetrahedrons, in the form of a square-based pyramid.*

PUZZLE XXIII. *Arrange eight equal regular tetrahedrons, and six equal regular octahedrons with faces equal to those of the tetrahedrons, in the form of a regular octahedron.*

PUZZLE XXIV. *Draw on a card twelve equal and similar diamonds (rhombuses), determining their common shape and their positions on the card so that they may be cut out in one piece, and by suitable bending of diamond towards diamond, each diamond remaining flat, may form the 12 faces of a symmetrical solid, having 24 edges and 14 angles, 6 of the solid angles being each formed by the meeting of 4 of the smaller plane angles of the diamond faces, and 8 by the meeting of 3 of their larger plane angles.*

MINUTE MEASUREMENT.

(*Continued from page 80.*)

WE have said previously that when extreme delicacy of measurement in an astronomical instrument is essential the micrometer microscope takes the place of the vernier. Now the very essence of the accuracy of this instrument resides in the absolute truth of the screw which moves its index and cross wires, and, inasmuch as the screw also forms the essential part of every instrument now in use for the measurement of exceedingly minute quantities, it may be as well in beginning this branch of our subject to say a few words as to its principle, and the methods in which a perfectly true screw is produced. If we turn to any popular work in which the so-called "mechanical powers" are described, we shall find the screw defined as a continuous circular wedge or inclined plane, whose outline may be formed by cutting out a wedge-shaped piece of paper and wrapping it round a cylinder. Then will the edge of the paper represent the outline of the screw thread, which obviously preserves a constant angle to the axis of the cylinder; the angle of the wedge, with a cylinder of unvarying diameter, evidently determining the coarseness or fineness of the screw. We may take it, for our present purpose, that a screw must have been originated by very carefully wrapping such a wedge-shaped piece of paper as we have described round a cylinder, and then, with equal care, filing a groove upon it, upon the line traced out by the edge of the paper. The screw being thus made as accurate as possible, would be converted into a "tap"—or cutter—by filing grooves round it parallel to its axis, and with this tap an inside or "female" screw would be cut, which inside screw, or "die" as it is technically called, would in turn become a cutter whence copies of the original screw might be produced in any number. As we are not writing an article on practical mechanics, we need not point out how, by a repetition of these processes, a correction being introduced at each stage, the resulting screws come nearer and nearer to perfection, nor describe the elaborate art by which perfectly true screws are now cut with 100 threads to the inch. We will take their existence for granted, and proceed to describe how they are rendered available for the most minute and delicate measurements. Perhaps as suitable and typical an application of the screw as we can select for this purpose may be found in the micrometer microscope, by the aid of which angular deviations are read off on the limbs of astronomical circles to the tenth and even hundredth of a second of arc. Let us take one of those used to read the division on the limb of a mural circle, or large Altazimuth instrument, the primary divisions on the circle representing intervals of 5′. Now the microscope itself is a compound one, with an object glass, and that form of eye-piece known as the Ramsden or "positive" one, consisting of two plano-convex lenses with their convexities turned towards each other. Then, as in every other microscope, an image formed by the object glass in its focus will be magnified by the eye-piece, when the focus of the latter is made to coincide with that of the objective by sliding the eye-tube in and out. It will further be evident that any material object placed accurately at this focal point will be seen superposed on the optical image formed by the object-glass. Now, in the instrument which we are considering, at such focus is placed the spider-line micrometer which is shown in fig 5. Here we see a rectangular frame, moved by the screw *sc*, whose milled head, MH, is divided into 60 equal parts. The circle represents the field of view of the microscope, and the short dark vertical lines *d d* are the 5′ divisions on the limb of the instrument itself. The comb C does not move with the spider-lines to be immediately referred to. The object-glass of the microscope is screwed up or down until five revolutions of the milled head carry the crossed spider-lines S L exactly from one division to the next. It must be, of course, thoroughly understood that the microscope itself is a fixture, and that the telescope and circle moving together carry the divisions on the latter across the field of the microscope; and if we suppose the middle notch of the comb C and the intersection of the spider-threads to be in a line, and the zero of the circle on the milled head to be opposite to its index (not shown in the figure), then will this intersection of the crossed spider-lines become a fixed point of reference, and the divisions which pass it as the telescope and circle rotate together will show the angle through which the telescope has moved. Let us now suppose, though, that instead of such rotation bringing

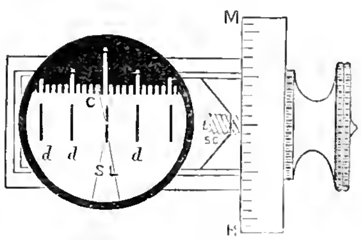


FIG. 5.

the cross accurately on to a division, it falls between two of them. In this case we turn the milled head until the intersection of the lines coincides with the graduation *beyond* which the motion of the telescope and circle has carried it, and read off the revolutions and parts of a revolution made by the milled head. Let us take an example. We have said that each graduation on the limb of the instrument represents 5′; and that exactly five revolutions of the milled head carry the cross-wires from one of such graduations to the next. Moreover it will be remembered that the milled head itself is divided into 60 parts. Now let us imagine that the graduation reads 274° 15′, and a certain quantity equal in terms of the micrometer to three whole revolutions (measured on the comb C) and 41·7 divisions of the milled head. This quantity, by which the cross-wires have to be moved back to coincide with the 15′ division obviously is equal to 3′ and $\frac{41.7}{60}$th of a minute, or 41″·7. Adding this, then, to the whole reading we say 274° 15′+3′ 41″·7 =274° 18′ 41″·7. If the reader has thoroughly grasped the principle of this instrument—and we would urge him to read and re-read our description until he does—he will see how, by making the thread of the screw very fine and the micrometer head very large, and, moreover, graduating the latter sufficiently minutely, there is scarcely any limit to our power of subdividing space. Suppose, for example, that the frame in fig. 5 were moved by a screw *s c* with 100 threads to the inch, and that the head M H (instead of having 60 divisions) were divided into 100 parts. Then, quite obviously, the turning of the screw through one of these parts would move the frame 100th of 100th—in short, $\frac{1}{10000}$th of an inch. An instructive illustration of the use of such a micrometer is found in the operations conducted between 1843 and 1854 for the construction of a standard yard-measure to replace that destroyed in the fire which consumed the Houses of Parliament in 1834. It is to the indefatigable labours of the late Messrs. Baily and Sheepshanks that we are mainly indebted for the possession of our present national standard, though as Mr. Baily unfortunately died a year after the commencement of the work, the overwhelming proportion of it devolved on Mr. Sheepshanks. The standard which had been destroyed was made by Bird, the optician, in 1760, from one, also of his construction, made in 1758; the last in turn having the Exchequer yard of Queen Elizabeth, constructed in 1588, and the yard of the Royal Society, dating from 1742, as its prototype. We have spoken just now of "the standard which had been destroyed"; but, as a matter of fact, both of Bird's yards—that of 1758 as well as that of 1760—were destroyed or irretrievably damaged in the fire in 1834. But other means of reference happily survived. *Imprimis*, there was General Roy's 42-inch measure, constructed by Bird, and first used for the measurement of that base on Hounslow Heath which was the very beginning and foundation of the Ordnance Survey. The first 36 inches of this were alone employed in subsequent comparisons, or rather two copies of that part of it. Then there was the yard constructed by Troughton under the direction of Sir George Shuckburgh, and a yard made by Capt. Kater in 1831. Formerly comparisons would have been made by means of beam-compasses, which, as most people are aware, consist of a rigid and absolutely straight bar of hard wood or metal, to one extremity of which is fixed a fine point at right angles to its length; while along the bar slides a box carrying a similar point, which can be moved by a screw, a vernier attached to the box showing the precise distance that the fixed and movable points are apart. But this, after all, was only a rough and ready method of taking off distances, and one open to the most serious objection that the mere insertion of the points of the compasses into the lines or holes defining the ends of the measure sufficed seriously to impair the graduation, to make the lines when magnified into ruts, and the points into irregularly-shaped pits, and so to gravely impair the value of the original as a standard. Instead, then, of the material beam compass, with its mischief-working points, the Commissioner employed what we may call an optical one in the shape of a bar furnished with two micrometer microscopes rigidly fixed 36 inches apart, beneath which the original bar was carefully supported, and bisections of the dots on it made by a contrivance analogous to that described above. By the subsequent substitution of the bar which had been copied from this original, the necessarily minute marks were brought under the microscope, and thus a series of comparison measures instituted. More than two hundred thousand (!) micrometer readings were taken from first to last, the larger part of them by Mr. Sheepshanks in the cellars of the old rooms of the Royal Astronomical Society in Somerset House, where the comparing micrometrical apparatus was fixed by Messrs. Troughton and Simms. We may add that one division of the micrometer head of this particular apparatus represented a movement of $\frac{1}{20000}$th of an inch. A similar application of what we have designated an optical beam compass is employed, in geodesical operations, in the measurement of the fundamental base lines. Such bases are, of course, measured rigidly in straight lines by rods most ingeniously devised to preserve an invariable length—a device which it may be worth while to digress for a short time to describe. There is a fact familiar to every one which is vulgarly and forcibly (if not quite philosophically) expressed by saying that "bodies expand by heat and contract by cold." In the case of the standard measures of which we have been speaking, it is definitely understood that the distance between the lines or dots on them is precisely 1 imperial yard *at a temperature of* 62°. If the thermometer rises above this, the interval exceeds 36 imperial inches. If it falls below that temperature, then is such interval less than a yard by an amount depending upon, and calculable from, the amount of that fall. But in the work of measuring a terrestrial base-line considerable difficulty will arise from variation of temperature in different parts of the line to be measured, and hence it becomes important to use measuring rods of an invariable length. Fig. 6 illustrates the extremely ingenious manner in which the absolutely unvarying length of these rods is insured.

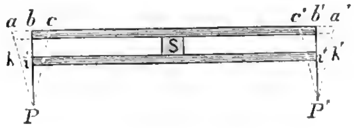


FIG. 6.

Reference to any work on physics will show that the linear expansion of brass is to that of iron in the proportion of 1894 to 1166 for any given increase of temperatures. Very well, then. We will suppose that $b\ b'$ and $i\ i'$ represent a brass and an iron bar respectively, connected by a steel tie, S: $b\ p$ and $b'p'$ being two flat steel tongues at their ends, moving on conical brass pivots, so as to permit them to move through small angles with the lines (bp, $b'p'$ in our figure above) square to the bars. These tongues are so adjusted that the lengths $b\ p$, $b'p'$ are to the lengths $i\ p$, $i'p'$ as 1894 : 1166, *i.e.* roughly as 5 : 3. Then a little attention will show that if the bars are made of precisely the same length at a temperature of, say, 62°, the tongues will be at that temperature accurately perpendicular to the bars, and $p\ p'$ will be at their precise length (say 10 feet) apart. If, though, we suppose that a change of temperature either expands $b\ b'$ to $a\ a'$, or contracts it at $c\ c'$, then as $bp : i\ p :: ba : ik$, and by similar triangles the points p and p' will remain at an invariable distance. Returning from this digression, we may just add that bars of this construction are laid end to end in wooden troughs in an absolutely straight line, and, if they could be brought into absolute contact, the process of measuring by their aid would be a comparatively simple one. To permit them to jostle, however, would be to introduce an element of possible serious inaccuracy. Hence they are brought as close together as they conveniently can be without coming into actual contact, and the intervening minute space is carefully measured by a micrometer microscope in a manner analogous to that previously described.

So far we have proceeded on the assumption that the bisection of the fiducial points whose distance is to be measured is made by the eye; but it is gravely doubtful if that organ is trustworthy for such a purpose beyond the $\frac{1}{100000}$th of an inch. How, then, are more minute quantities still measured? A very brief account of Sir Joseph Whitworth's perfectly marvellous machine, which measures unerringly to the one-millionth of an inch (!), may enable us to understand how this is effected. In this case the measurement is tactile and not visual, and is effected in a manner which may be summarised thus. Premising that this astonishing piece of mechanism is only capable of measuring *end*-lengths, we may say that it consists of a massive cast-iron bed, with head-stocks at each end, something like those of a lathe. Extending centrally along the top of the bed is a V-groove running the whole length between the head-stocks. In this groove slide two square bars so accurately fitted to the groove that they slide with no perceptible friction and with absolute steadiness. The ends are worked rigidly square to their sides and (what we may call) their inner ends, or those furthest from the head-stocks, are turned up in the lathe, so as to present two rigidly flat circular discs. Through each head-stock runs a micrometer screw, made with extreme care, by turning which the bars are advanced along the V-groove. Each of these screws has 20 threads to the inch. The micrometer head of the left-hand screw is divided into 250 parts: so that if we turn this forward through one division it advances the bar against which its free end abuts $\frac{1}{20} \times \frac{1}{250}$—*i.e.* $\frac{1}{5000}$th of an inch. The right-hand screw is driven by what is called a worm-wheel, or endless screw, of 200 teeth, and the screw gearing into this carries a micrometer head with 250 divisions. Hence it will be seen that the advance through one division of this last-named head must move the bar touched by the primary screw $\frac{1}{20} \times \frac{1}{200} \times \frac{1}{250}$th of an inch—in short, through exactly the one-millionth of an inch. Of course each of the micrometer heads has a fixed index, by which it can be read. Suppose, now, that we have a standard inch bar with which we propose to compare a duplicate. Our standard is constructed just like the original bars, and, as in their case, fits accurately into the V-groove in the bed of the engine. The free end of the left-hand screw is in actual contact with the left-hand end of the standard; but between its right-hand end and the free end of the right-hand screw is interposed a steel plate with rigidly parallel sides, called by Sir Joseph Whitworth a "feeler" or "gravity piece." This has two handles (something like those of a tap-wrench) which rest on two shelves fixed one on each side of the bed. When the pressure exerted by the screw is imperceptible, if we lift one of these handles the feeler drops again by its own weight. When, however, the pressure is so regulated that the feeler can be moved and yet does not fall when the handle is released, the instrument is in adjustment. We will imagine this to be the case with our standard inch bar. Then the reading of the right-hand micrometer head is accurately noted. We now turn it backwards, release the gravity piece and the standard, and take the latter out, replacing it by the duplicate to be tested. If the micrometer head goes back to the same position as it at first occupied, then are the bars of identically the same length; if not, the number of divisions gives the millionths of an inch by which they differ. The motion of the screw through *one division* of the micrometer head will release the feeler when the instrument is accurately adjusted.

Merely as a matter of course the instrument which we have been endeavouring to describe is almost infinitely too delicate for use in the workshop. At the same time, however, patterns and templates are now worked to a degree of rigid accuracy which would almost strike the engineers of the early part of the century dumb with amazement, and for the purposes of those refined measurements now imperative, Sir Joseph Whitworth has devised a somewhat more simple form of engine. This consists, in effect, of a small bed, like that of a lathe, upon which are mounted two head-stocks, very much like the poppet which carries the back centre in an ordinary turning lathe. Here the right-hand head-stock is a fixture, and the left-hand one slides along the bed by means of a screw within it, the face of the bed being graduated in inches. This graduation enables the head-stocks to be at once placed approximately at the required distance apart. The movable head-stock has a screw within it of one-twentieth of an inch pitch, furnished with a micrometer head with 250 divisions upon it. As in the case of the more elaborate instrument, however, this left-hand head, once adjusted, is a fixture, and the measuring is effected by the right-hand one, through which travels a screw also with 20 threads to the inch, whose head is graduated into 500 parts. Hence it will measure a difference of length equivalent to $\frac{1}{20} \times \frac{1}{500}$, or $\frac{1}{10000}$th of an inch. With the description of a more simple instrument still, the pocket thousandth gauge sold at Churchill's and other tool warehouses, we may conclude our account of devices for minute linear measurement. It is illustrated in fig. 7.

Here the screw has 50 threads to the inch, and its milled head is divided, as is seen in the sketch, into

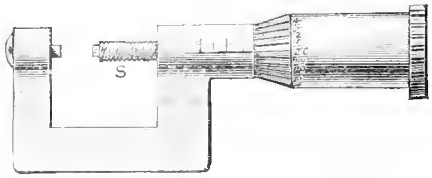


FIG. 7.

20 parts, each of such parts quite obviously corresponding to a motion end-ways of the screw of $\frac{1}{50} \times \frac{1}{20}$, or $\frac{1}{1000}$th of an inch. This is a very handy little affair, and is a good deal in use among physicists, and a most portable and convenient instrument for measuring minute lengths rapidly and conveniently.

MYTHS OF NIGHT AND WINTER.

By "STELLA OCCIDENS."

WE have all heard the fairy tale of the "Sleeping Beauty." At her birth all the fairies but one were invited. Each gave the princess some good gift. But the one who was not invited predicted good fortune only until the day the princess should prick her finger with a spindle. On this account all spindles were kept out of her sight, locked up in a room, which she was never allowed to enter. One day, as she was wandering about the castle, she entered the forbidden room, and, whilst playing with a spindle, pricked her finger. Instantly the castle fell under the spell of enchantment. The princess remained spell-bound at the spindle, and everyone in the castle remained as they were at the moment when the accident befell.

After several years had passed a dense forest hid the castle from sight, and it seemed as though the Sleeping Beauty might sleep on for ever. But a prince, who had lost his way whilst hunting in the forest, perceived the castle, and sought to see who lived there. Entering, he found the Sleeping Beauty, and as he kissed her the spell of enchantment was broken. She instantly awoke from her long sleep, and all was restored to life and animation in the castle.

This story corresponds strangely with a German legend of an ancient town on the Rhine, called Xanten. Here stood the Castle of Nibelungen, and here Siegfried, the dragon-slayer, was born. Tiring of the quiet life at home, he wandered forth in search of adventures. Among other exploits he destroyed a dragon. He threw the carcass in the fire, and a stream of fat running out, a little bird, sitting on a tree above him, sang to him that if he bathed in the dragon's blood he would become invulnerable. He did so, but one spot on his shoulder was untouched by the oil owing to a leaf which had fallen from the tree. Siegfried travelled down the Rhine until a storm drove him on a rocky coast. His horse brought him to a castle surrounded with flames, through which the little bird told him to leap. After passing through the flames, the little bird told Siegfried that he would find a spell-bound maiden, under the power of a magician, shut up in a castle. Siegfried entered the castle. The stillness of death was on all the inmates. The servants were in the position in which they had been at the moment of enchantment: the cook before the fire, the butler pouring out a glass of wine, the groom before the horses, and the very animals immovable before the mangers. At length Siegfried entered the hall, where he found a beautiful maiden sleeping on a couch, and bound with brass bands. Siegfried cut the bands, and, kissing the maiden's rosy lips, instantly released her from the spell of enchantment which had endured for a century.

One would scarcely think of associating legends such as these with nature myths, yet the wintry sleep of nature and the sun sinking to rest in the caverns of night, have been symbolised by innumerable stories such as these, of spell-bound maidens rescued by princely heroes. In the story of the "Sleeping Beauty" the prince is Spring, who rescues the spell-bound maiden (or the earth) from her deep slumber beneath the icy mantle of winter. Locked in her ice-palace, the Sleeping Beauty is restored only to life and activity when the first bright rays of the Sun-god awaken her. Every nation, indeed, has a myth corresponding with the above legends, though differing somewhat in the minor details.

In the "Arabian Nights" we find the well-known story of Codabad and his brothers, over whom his father placed him in authority. Codabad at their urgent request allowed them to go out for a day's hunting. When several days had passed yet they did not return, the father made Codabad go in search of his brothers, threatening the utmost weight of his resentment if he did not bring them safely home again. He disguised himself as a shepherd, and started on his travels. He arrived at a plain of great extent, in the middle of which he saw a palace of black marble (the mansion of Night). When he drew near, he saw a beautiful lady at one of the windows, who entreated him not to enter. "Alas, young man!" she said, "escape as fast as possible from this fatal place, or you will fall into the hands of the monster who inhabits it. A cruel black giant (Night) who feeds chiefly on human flesh, resides in this palace; he seizes on all persons whose ill-fortune conducts them to this plain, and shuts them up in his dark dungeon, whence they are never let out but to be devoured by him."

Codabad asked the fair prisoner if he could not save her from such a fate, but whilst he was yet speaking the giant approached them. He was a man of enormous size and dreadful aspect, and wore such a large and mighty scimitar that no one but himself could use it. However, Prince Codabad drew his scimitar, and stood upon the defensive. The giant would have passed him unnoticed, telling him to move out of his way, but Codabad struck the giant such a blow on the knees, that he fell on the ground, yelling with pain. He struck at Codabad with his great scimitar, but the Prince aimed a blow at his right arm, and cut it off. The giant fell, and the earth quaked beneath him. Codabad completed the victory by chopping off the giant's head, and the fair lady was free. The rest of the prisoners in the castle were released, and among them Codabad found his forty-nine brothers.

This story somewhat resembles the account of the Panis in the Rig-Veda, who are genii of Night and Winter. They steal the cattle of the Sun, and carry them toward a dark cave in the east. Sarama, the creeping Dawn, is sent by Indra to try and recover them. The cattle of the Sun are the clouds or cloud-maidens. In the myth of the Argonauts they appear as the Golden Fleece, carried to the east by Phrixos and Helle, who are themselves Nibelungs, or "Children of the Mist" (Nephle), and are there guarded by a dragon. In all these myths a treasure is stolen by some power of darkness, and recovered by a hero of light who slays the demon.

Among the Nibelungen lays, we find the famous myth about Fafnir, who steals the Valkyrie Brynhild, and keeps her shut up in a castle on the Glistening Heath, until some champion shall be found powerful enough to rescue her. The hero who saves her is Sigurd, the Northern Achilleus.

Riding on his deathless horse, and wielding his resistless sword Gram, he forces his way into the castle, slays Fafnir, and recovers the Valkyrie. The Valkyries are also cloud-maidens, or Nibelungs.*

There is some resemblance to be traced between the horse which bears Sigurd into the place where Brynhild is imprisoned, the wooden horse which enters Ilion, and the Druidic steed which leaps with Sculloge over the walls of Fiach's enchanted castle.†

Among the Greek legends we have the account of Odysseus, who is ensnared by Calypso, the nymph of darkness, and kept in bondage. Then we have the story of Hercules, who, whilst reposing by the banks of the Tiber, has his cattle stolen by the three-headed monster Cacus. He drags the cattle (or clouds) into a dark cavern (Night), and does not recover them until he breaks open the entrance of the cavern and destroys the demon. Professor Fiske tells us that the three-headed monster is a near kinsman of Geryon's three-headed dog Orthros, and of the three-headed Kerberos, who guards the dark regions below the horizon. He is the original were-wolf or Rakshasa, who steals the bright cattle of Helios, and hides them in the black cavernous rock, from which they are afterwards rescued by the Schamir or lightning-stone of the solar hero.‡ Then we have the beautiful myth of Endymion, his name being one of the many names of the Sun, but having special reference to the setting-sun. Endymion sank into an eternal sleep in the Latmian Cave, or cave of Night, after living but one day. Selene the Moon sees him, loves him, and keeps him captive. In the poetical language of Elis, people said, "Selene loves," instead of "it is getting late"; "Selene embraces Endymion," instead of "the Sun is setting," and "the Moon is rising"; "Selene kisses Endymion into sleep," instead of "it is Night." §

This myth reminds us of the story of Tannhäuser, the Frankish knight, who lost his way whilst travelling at twilight past the Hörselberg. "He saw a white gleaming figure, of matchless beauty, standing before him, and beckoning him to her." He left his horse and disappeared behind the moonlit cliffs, lured by Venus Ursula, the fair goddess of Night. She kept him captive for seven years, and then, longing once more to return to his old home, he prayed to the Virgin Mother, who released him. Finding no priest who would absolve him from his sin, not even the Pope, whom he journeyed to Rome to see, he returned in despair to the Venusberg, and has never been heard of since.

Even the story of Rip Van Winkle, who wandered away among the Catskills, lured by the gnomes, and returning after a sleep of twenty years, is unrecognised and forgotten by his own wife and child, had its origin in the nature myths of Winter and Night.

(*To be continued.*)

* "Myths and Myth-makers." Fiske, p. 132.
† Ibid. p. 187. ‡ Ibid. p. 118.
§ "Chips from a German Workshop," p. 80. Max Müller.

AMERICANISMS.

By Richard A. Proctor.

Fence-riding, the art of remaining on the fence (see December number). It is to be carefully distinguished from riding on a rail, though a fence-rider not unfrequently ends his career by being a rail-rider.

Fetch. Bartlett notices the nautical phrase "to fetch up all standing," and thence simply to "fetch up," meaning to stop suddenly, as an Americanism—though this expression is probably much commoner in England than in America. But he altogether overlooks the Americanism, "to fetch," as meaning to influence strongly. The expression is used provincially in this sense in England; but it is commonly so used in the States, even by educated persons. Thus I remember a college professor telling me how unwilling he had been to accede to a publisher's request that he should write a treatise on the sun, till told that if he would not another person, whom he knew to be incompetent, would be invited to write the volume. "That *fetched* me," he said with emphasis; meaning that that was an argument he could not resist.

Few. Used for "a little," may be a shade commoner in America than in England. But so common a Cockneyism can hardly be called an Americanism.

F.F.V., First Families of Virginia.—A term used under the amusing delusion that the original settlers in Virginia were all, or nearly all, descended from the noblest families (in the conventional sense) in England. There were five or six such among the first two hundred; and not all even of those few left any to succeed them. But the great majority were much more useful settlers. The first wives of the settlers were sent out as assorted samples, purchaseable at as many pounds of tobacco as they would bring. They averaged 120 lbs. of the best Virginian. The next lot brought 150 lbs. per head. The First Families delusion, however, does no harm. Perhaps in some cases, by suggesting the thought that *noblesse oblige*, it does good, like the corresponding idea in England of which our Thackeray has made amusing use. The *New York Tribune* asserted in August 1861, that F.F.V. had come to stand for Fast Footed Virginians, because of undue alacrity displayed before the enemy. We had supposed in England that the Virginians at Bull's Run had been fast-footed with face forward to the foe. But the newspaper writer may have been too far from the field to know how the matter really stood, or how the foemen on either side really ran.

Fice, or Fyse. In Kentucky a small dog or cur. Nares has the word in his glossary in the form "fyst," as "a foisting hound or cur of the lap-dog kind."

Figure, To. As, "you may figure on that," meaning you may count on that. Also, but less commonly, figure is used for thinking over; as "figure on that"—"think of it." This, the only meaning given by Bartlett, is probably the original meaning of the expression. He gives the usage as Western, but it is quite commonly heard in New England.

Filibuster. From the Dutch *vrijbuiter*, German *freibeuter*, English *freebooter*, the French *flibustier*, or the Spanish *filibustero*. The word has come into tolerably free use in America, especially South-west. It may be understood as the equivalent of "freebooter." The following passage from a letter written by General Henningsen to Senator Toombs in 1857 gives a good idea of the use of the word, both as noun and as verb, and is worth reading for other reasons:

"What was Moses but a *filibuster*, whose mission was to dispossess tribes retrograding (or whose civilisation was corrupting before matured), and to plant in their stead another people, whose subsequent annals show them to have been at least in nowise superior to our own? What were the Normans from whom the sovereigns of Great Britain affect to derive their descent, and a portion of their title to the crown, but *filibusters*? What the Pilgrim Fathers but *filibusters*? What State, what territory in this Union has not been *filibustered* from the Indians, or purchased from those who had *filibustered* it? Have ever five years elapsed down to the present time, since the landing of the Pilgrim Fathers, that some of the Monarchies of Europe have not, somewhere, been *filibustering* something?"

Filibusterism. An elegant derivative.

Fillipeen, or Philopeen. It seems probable that this word "Fillipeen," certainly derived from the German *Viel-liebchen*, reached us in England from America, where German words, as well as German ways and customs, are more common in social and family life than in the Old Country.

Fill the Bin, To. To answer to a description, be the person asked for, or the like. Are you so and so? says question, "and then comes answer like an Absey book," "I fill the bin."

First Swathe. Equivalent to our English slang "first chop."

Fits. "To give any one fits," sometimes "particular fits," means to make him singularly uncomfortable, or to give him startling evidence of disgust at something or other he has done. The expression is often heard now in England, but I fancy, from the frequency with which it is heard in America, that it had its origin over the water. Our English slang equivalent would be "I'll make him look nine ways for Sunday"—that is, I presume, for Sabbath rest. The literary reader will immediately recall here the introduction of this expression into a description (in the classical pages of *Punch* nearly thirty years ago) of a fight between Tom Sayers and Bob Travers, where we were told how Tom gave Bob a straight one which

> Made him look nine ways for Sunday and finally fail to perceive it.

Fix. A predicament or condition. To be "in a fix," as equivalent to being in an awkward situation, is about as commonly heard in England as in America. But I think the origin of the expression, regarded as a form of slang, is Transatlantic.

Fix, To. The use of this word in the sense of arranging, and where the idea of fixity is not at all implied, would seem to have arisen from some confusion between fingency and fixation—as if the word had the meaning of the Latin *fingo, fingere*, instead of that only of the Latin *figo, figere*. At least I know of no use of the word "fix" in America which would not fairly represent the meaning of one or other of the two verbs *fingo* and *figo*. It certainly has a strange effect to hear "fix" used in one of the wrong senses—as "Let me fix that feather," when the idea is to make it wave naturally; "I will fix the table," meaning "I will lay the cloth and set the plates, knives, forks, &c.;" or still more oddly when, as I heard it used only a day or two since, in reply to a child's cry, "My dress is caught, I wish you would loosen it," the answer comes, "Wait a moment and I'll fix it."

PUBLIC SCHOOLS ATLAS.*

BETTER provision has been made in this work for teaching our public school boys geography than has been made to teach them Latin and Greek in all the nonsensical grammars written for them from the days of the Tudors until the last most monstrous wrong was done the young folk by the "Public Schools Grammar," published a few years ago. Why geography should be taught sensibly and languages in a blunder-headed manner it were difficult to say; but certainly it is fortunate that the preparation of books on geography did not fall into the hands of the wiseacres who discovered that extremely difficult logical questions involved in grammar were fit food for boyish minds. (Puzzle out, reader, the true significance of a few such words as *declination, case, genitive, ablative, adjective, conjugation, supine, gerund*, &c., and the complex nature of the problems you were *supposed* to deal with at school will be clear to you.) Because, if geography had been dealt with in the same way we should have had our boys learning the formulæ for the barometrical determination of heights before they were told the heights of the various mountains on the earth, or studying the differential equations for fluid motion before they learned the courses of the principal rivers. (This may seem extravagant; but ask the fifty leading philologists of the world to tell the boys who learn of *supines*, for example, the logical significance of the word—and why those particular verbal forms might not equally have been regarded as *prones* or *uprights*—and guess from their replies whether the logic of grammar is not as far from being fit teaching for young folk learning languages as mathematical formulæ from serving as a proper introduction to geographical matters.)

In the book before us we have geography illustrated in a very simple and attractive manner. The scale of the maps is adequate. They are not so overcrowded with names that the wood cannot be seen for the trees. The rivers are clearly and effectively represented from their sources, and the positions of towns with reference to them and to the sea-coast have been very carefully indicated. There are not too many maps, yet there are enough for the purpose aimed at, and the atlas is cheap.

As regards details, the following features seem decided improvements on the old plan. The names of countries and of their chief divisions have been engraved more compactly than of old, the initial letter of each chief word being relatively larger than usual; the names are engraved horizontally wherever this has been possible; and with one exception (the United States) the maps have not been folded.

To one feature of the maps an exception must be taken. While the outlines of the continents and islands, the courses of rivers, and the positions of towns, are printed in blue, the meridians and parallels, the outlines of countries and counties, and the names of places are printed in black. So far as the colours are concerned this arrangement is convenient enough. But when we remember how the two printings are necessarily managed, and that by no possible arrangement can exact "registering" be obtained (simply because the wetted paper expands irregularly, and is irregularly compressed at each printing), we see that the meridians and outlines of countries should be given by the same printing as the rivers and the outlines of continents—necessarily, therefore, in the same colours. The names and the map frame might be separately printed (black), and no harm done, but the outlines of countries and counties cannot be safely so printed, and for the meridians and parallels to be separately printed is seriously objectionable. These are, in effect, the measuring marks on maps, and to have them wrong is to have the whole map wrong. When we have mentioned that in our copy, Greenwich, owing to defective registering, appears to be measurably east of the first meridian, which we know is the meridian of Greenwich, the fundamental character of the defect will be recognised. Of course in another copy Greenwich may appear west of the meridian, and in some copies may chance to be just right. But this does not mend matters. In every copy some maps must have every single town shown in wrong longitude or latitude.

The maps of this atlas are of course drawn like those of

* "The Public Schools Atlas of Modern Geography, in 33 Maps." With an introduction by the Rev. Geo. Butler. New edition. Longmans & Co., London. Price 5s.

all other atlases, on the projections which were employed two centuries ago, which served very well at a time when men had very vague ideas of the true outlines of continents and countries. Spain, as it appears in the map of Africa, is quite another Spain from Spain in the map of Europe. And so with many other cases. But probably in three or four centuries more truthful projections will come into use.

Gossip.

By Richard A. Proctor.

Professor Newton, of Yale College, has advanced a theory of the origin of meteors, which Professor Young, of Princeton College, has endorsed, apparently giving up Schiaparelli's. According to this theory, meteors are the fragments broken off (when or how the deponent sayeth not) from comets. The theory labours under the slight objection of explaining none of the characteristics either of comets or of meteors. In fact, most of the theories of comets and meteors which are at present chiefly in vogue—I mean in regard to numerical acceptance—are like the Hindoo theory of the earth's stability, according to which the earth stands on an elephant, the elephant on a tortoise, that on something else, and so on *ad infinitum*. Thus Schiaparelli taught that meteors travel in the tracks of comets, that comets were meteor streams gathered out of the star depths, and meteor streams got into the star depths out of somewhere else, leaving us there in infinite uncertainty. Professor Newton interpolates a link, which still leaves the perplexity at the farther end of the chain undiminished—meteors, it seems, follow in the tracks of comets because they were chipped from comets. Were we not better off with Schiaparelli's theory pure and simple?

* * *

The *Times*' record of "Science in 1886" is manifestly from the versatile and discriminating pen of Mr. J. N. Lockyer. The progress of astronomy, in which I naturally take chief interest, is full of promise. It appears to be included in two statements. First, a solar eclipse occurred in August, "to observe which a party was sent from England under the direction of Mr. Lockyer;" and secondly, "the laboratory for solar physics at South Kensington, under the superintendence of Mr. Lockyer," is still "groping for a solution of the great problem in solar physics which Mr. Lockyer is understood" (it is really Clarke's, of Cincinnati) "to have started." The "fascinating theory," as Mr. Lockyer calls it, will soon, he is convinced, be established: this theory being that "It only requires heat enough to convert everything into glowing hydrogen." One recalls just here the theory of the fascinating next-door gentleman, on the garden wall, in "Nicholas Nickleby," who promised that, under certain conditions, all should be "gas and gaiters." Gaiters do not appear in Mr. Lockyer's theory, but there may be reference to them in the remark (not apparently justified by the recognition of hydrogen as the element which is in and through all things) that the solar physics work at South Kensington is evidently "very excellent," and "pregnant with practical issues for humanity." It is to be hoped so, for a goodly sum is paid each year for the work; and some men of science have been unkind enough to say that nothing worth the paper on which it has been recorded has been done by the solar physics folk. But their superintendent ought to know; and since he says their "very excellent work is pregnant with practical issues for humanity," we must possess our souls in patience and wait to see what this singularly mixed metaphorical promise may imply in the way of performance.

A few days ago my partner at whist had a hand with no card above an eight. Within two days I was told by a whist-player, at one of the places where I was lecturing, that he had had such a hand, and was asked if I had ever heard of a hand so poor. The coincidence was strange enough, but hands even poorer are on record. "Pembridge" mentions a hand with nothing in it above a five, and only one five. I think he mentions Surbiton as the place where the hand was dealt if that matters. If the chance of a hand with nothing above an eight is required, we get it by noting that, while the number of possible hands is

$$52 . 51 . 50 . 49 . 48 . 47 . 46 . 45 . 44 . 43 . 42 . 41 . 40$$

(which call A), divided by the product of the first thirteen numbers, the number of hands with no card above an eight is

$$28 . 27 . 26 . 25 . 24 . 23 . 22 . 21 . 20 . 19 . 18 . 17 . 16$$

(which call B) divided by the same product. Hence the chance of a hand with nothing above an eight is represented by $B \div A$. This I find to be 1 in $16959\frac{146}{171}$; so that the odds are $16958\frac{146}{171}$ to 1 against such a hand being dealt to a given player at any given deal.

* * *

A correspondent sends a singularly evolutionary attack on evolution from the *Christian World*. Mr. S. R. Pattison, under pretence (at least, so I suppose) of attacking evolution, tries to show that "there has been an unfolding of the Divine plan throughout the ages, by steps, not by an inclined plane, every step being a separate creation." This, of course, is evolution pure and simple, despite the word "creation." A man's son differs in finite degree from the man, and is in that sense a separate creation; and no evolutionist believes in an inclined-plane process of development which would involve an infinite number of generations. Mr. Pattison adds that metaphysics knows nothing of evolution in the nature of a force from without. Neither does science, evolution being in its very essence a process working from within.

* * *

I have sometimes wondered that no one seems to have recognised as the main theme of the synoptic gospels—coming again and again into prominence—the absurd impertinencies of humbugs and hypocrites, and the quaintly humorous but crushing way in which they were dealt with.

* * *

Mr. E. L. Garbett, with whom I have had some slight "passages" in past times, having studied the prison-cell puzzle and the Josephus puzzle as presented at p. 43 (Knowledge for December), writes as follows:

> These two puzzles are marvellously parallel. Of the 36-cell puzzle, Mr. Proctor "believes" there is a solution. Well; just colour the cells chessboard-fashion, and you see that every move must change your colour. You are to visit all the cells, therefore to make 35 moves. An odd number of moves must (like a single move) change your colour. But A and B are of the same colour! Yet Mr. Proctor "believes" there is a solution—that is, that you can get from A to B by 35 moves! That is about equivalent to believing that such a book as Josephus's "Antiquities," under patronage of and circulated by command of an imperial Cæsar, could have forgeries interpolated. A man who can believe either of these must be about the most credulous of miracle-swallowers alive.

* * *

Mr. Garbett's style is a trifle crisp. One is reminded of the schoolboy manner, "Well, you *must* be a thundering fool to believe that." An odd thing, too, is that I had not myself thought it necessary to point out to the readers of Knowledge, not wishing to insult them, what Mr. Garbett so kindly points out to me. It seemed too obvious. It was clear that the solution must be by a dodge of some sort. I was far too busy to give any attention to the puzzle when I threw it in, just as it stood, with my Gossip. But the moment one looks (anyone, it would seem, except Mr. Garbett) for the solution, it is as obvious as that, without the dodge, no solution would be possible.

* * *

As for the Josephus puzzle, the question of interpolation has in reality very little to do with the matter. Nearly every commentator of repute has admitted that the passage relating to Jesus is an obvious and a most clumsy forgery; and if the passage relating to John the Baptist is not a forgery, then, since it is entirely inconsistent with the Gospel narrative, we get a more difficult puzzle by its admission than when we reject it. As for the patronage and command of an imperial Cæsar (not a Christian), how that would prevent interpolation centuries after that imperial Cæsar was dead and turned to clay, Mr. Garbett might find it difficult to show. That interpolations and forgeries of the most unscrupulous kind were rife in the third, fourth, and following centuries, that as Eusebius, prince of liars, proclaimed that it was held right to forge and lie for the glory of Christianity, we know; and we know no reason why Josephus or Tacitus, or any non-Christian writer of the critical first and second centuries, should have escaped the process, no matter what imperial Cæsar had patronised them or commanded them to prepare the treatises they wrote.

* * *

But the passages regarded by all competent critics as interpolations in Josephus, and those regarded by many competent critics as interpolations in Tacitus, would if accepted prove nothing beyond what is tolerably well known without them. It would indeed be preposterous to assert on the strength of the doubtful passage about Jesus Christ that Josephus regarded him as the Messiah, for Josephus manifestly (fifty pages could be cited to show this) regarded his countrymen's hopes about the coming of the Messiah at that time as fallacious and dangerous. But if Josephus really wrote and really believed it (which is absurd) that would no more help to establish the belief ascribed to him than Tacitus's description (supposing the passage not interpolated) of the Christians as malefactors would prove them to have been such.

* * *

Some correspondents, by the way, have dwelt rather strongly on Renan's acceptance of the more than doubtful passage in Josephus relating to Jesus. The fact that Renan does not refer to the question whether the passage is genuine shows that he had not critically examined the matter. He refers to the passage in such a way, too, as to imply precisely that view of the puzzle which I have indicated. His words are: "*Josèphe, né l'an 37 et écrivant sur la fin du siècle, mentionne son exécution*" (*l'exécution, c'est à dire, de Jésus*) "*en quelques lignes, comme un événement d'importance secondaire.*"

* * *

Of course the real Josephus puzzle resides in the circumstance that many of the facts related by him as occurring thirty or forty years after the alleged date of the crucifixion seem to have been worked into the narratives given in the synoptic gospels. The puzzle to be solved is to explain how this may have happened through sheer coincidence, or, if this is impossible, then to show whether Josephus, writing in the first century, borrowed for his history events which had really happened thirty years before the time he assigns to them, or whether the borrowing was the work of the synoptical evangelists writing some half a century later.

By the way, in the second paragraph, on the second column of p. 50, there is a rather curious blending of statements. After "a work with which Enoch had nothing to do" there should have been a full stop. Then this "Matthew appears to have left a record in writing of the teachings of Christ, which are quoted—probably from Matthew's record—in the gospel *according to*, certainly not *by*, Matthew. This gospel appeared in all probability," &c. This sets the paragraph right, except that in the seventh line from the end, "The Gospel" should be "this gospel."

* * *

"A Square" sends a "wail from Flatland," or, in other words, the well-known Tridimensional, whose romances of Flatland have touched many students of quadri-dimensional mathematics, has sent a letter describing the anguish of "A Square" imprisoned in such cells as Mr. Garbett failed to find escape from. We would publish this piteous lamentation were more of our readers quadri-dimensional; but the number of such readers is so limited, that we must ask the ingenious author to forgive us if we refrain. Will he kindly regard his letter as printed in planes persistently perpendicular to those of the pages of Knowledge.

* * *

W. E. H. sends some remarks on the Knight's Tour at Chess. The subject has been, however, so exhaustively treated already that we must not touch it. We are rebuked already for allowing those Fifteen charming School-girls to disport themselves in our pages.

* * *

A military correspondent points out that the six lines enclosing ten spaces, if set in the manner shown in fig. 6, page 9 (Knowledge for November), can be arranged so as to give a symmetrical figure, by making the large outer triangle and the centre triangle equilateral. The figure thus obtained does not fulfil any of the conditions of axial symmetry to which I referred. The symmetry is of the three-legged Manx-arms description. My arrangement has this kind of symmetry, *plus* tri-axial symmetry.

* * *

The same correspondent expresses a wish that the first page of the cover of Knowledge should bear no advertisements, but be wholly given to title and the contents. He says, "none of the best periodicals have advertisements, to my knowledge, on the front of the cover, but the contents are printed in plain type, the articles and authors being distinguished by a different type, so that one can see at a glance what the magazine contains: this seems to me most necessary." The cover of Knowledge is nearly the same in the monthly form as it was in the weekly, and our correspondent is aware that the *Athenæum* and *Academy*, to mention no other weeklies of similar standing, have advertisements on the first page of cover. It did not seem worth while to change, especially as on the stalls only a few inches near the top of quarto publications are displayed. Any one who has to take out the magazine to see the front page in full can readily at the same time see the contents as at present printed. The change recommended would involve a considerable yearly loss; and already the expenses of Knowledge run so close to the possible proceeds of its sale (we *did* have it for a time so that the more copies were sold the greater the loss) that a change of the kind is practically impossible. Let Knowledge be compared, simply in quantity of matter, with any periodical of the same character, and it will be recognised how we are handicapped.

* * *

Mr. Alfred Brown has succeeded in trisecting the angle, "and can give geometrical proof of the same." He desires to know what is the value of the discovery to me for publication. The angle can be trisected geometrically in hundreds of ways. In my "Geometry of the Cycloidal Curves" there is a trisection. The difficulty is to trisect the angle by a method which shall involve the use only of the line and circle—that is, ruler and compasses. Supposing Mr. Brown had managed this, which is equivalent to supposing that he had discovered a way of making steel rails out of cheese-cakes, the discovery would be worth a sum which may fairly be represented by x sovereigns, where x is the root of the equation, $x^2 + (1,000)^2 = 0$.

* * *

The following words of a letter I have just received from a friend in London, who kindly sifts out all Knowledge correspondence, and forwards to me only what is worth forwarding, may save a certain class of correspondents trouble:

> Some kind correspondents are solicitous about your soul, and add to the store of the waste-paper basket.

My friend evidently shares my opinion that any one who imagines it his duty to turn from the culture of his own soul-business to inquire into the soul-business of others, is necessarily what the profane call a humbug, and probably a hypocrite.

Reviews.

The Functions of the Brain. By David Ferrier, M.D. (London: Smith, Elder, & Co. 1886.)—Dr. Ferrier's work on the functions of the brain is already a classic on the subject with which it deals. This second edition has been largely rewritten, and much new matter has been added, bringing the book up to date in every particular. The larger portion consists, as before, of Dr. Ferrier's own experimental investigations into the localisation of faculty in the various regions of the brain; but these are expanded into a systematic exposition of the entire subject by the addition of much recent physiological and pathological material. As yet, our knowledge in this direction is of the inchoate sort which, for the most part, interests specialists alone; the results are still few and hazy; the faculties localised are vague and psychologically unimportant: and only students of nervous phenomena are likely to wade through the long details of Dr. Ferrier's operations on dogs and monkeys. The electrisation of portions of the hemisphere was followed, as a rule, by special movements of the limbs or other relatively uninteresting motions. Cerebral topograpby, in fact, must reach far higher planes than this before it becomes a matter of popular study. The results so far are immensely valuable, but valuable as first indications only. We shall have still to wait a long time before we get a real knowledge of the way the brain works and the parts performed by its several portions.

Modern Methods of Illustrating Books. (Elliot Stock.)—This book is the latest addition to "The Book Lover's Library," edited by Henry B. Wheatley, and although the title-page does not bear any author's name, Mr. H. Trueman Wood's name appears on the cover, and he is presumably mainly responsible for the contents. In the preface he says that he has endeavoured to avoid technical details except such as were necessary to make descriptions intelligible, and, with a view to help those who may require fuller or more special information, he has added in an Appendix a list of a few works where the best information can be obtained. Much valuable and interesting information is given as to various methods of illustrating books, but the main interest of the work is in the description given of some of the many modern "processes" which are now so much in vogue, some of which bid fair to supersede wood-engraving for certain purposes. The information given as to the methods pursued by the inventors of these various processes is necessarily limited, as they are mostly worked in secret, but the whole of the work is very interesting to those engaged in the production of books, whether as authors, printers, or publishers.

Hazell's Annual Cyclopædia, 1887, containing nearly 2,000 Concise and Explanatory Articles, on every Topic of Current Political, Social, and General Interest referred to by the Press and in Daily Conversation. Edited by E. D. Price, F.G.S. Revised to February 7, 1887. Price 3s. 6d. (Hazell.)—We give the title of this book in full in order that we may say at once that the contents fully justify it. There is scarcely any subject of current interest that we have not found mentioned, and, judging from those subjects on which we presume to be competent to speak, we must say that the details given are exceedingly accurate. We cannot speak too highly of the general conception and execution of the work, and shall now look upon it as an indispensable supplement to the indispensable "Whitaker." To illustrate this we will take some subjects at random, on all of which in "Hazell" are given very useful information, but on none of which can we get any help from "Whitaker": viz., *Kyrle Society, Socialism, Bi-metallism, Jezreelites, Tithes, Noms de Plume, Noms de Théâtre, Society for Psychical Research.* One of the most interesting features is the series of short biographies of living celebrities, both English and foreign; but the most useful articles, we think, are those devoted to subjects of current interest, but which are frequently those on which the generality of the public have little accurate information. We may quote as illustrations the articles on Socialism, Tithes, and Bi-metallism, mentioned above.

The World of Thought. A Novel. By the Author of "Before I Began to Speak." (London: Simpkin, Marshall, & Co.)—*Landon Deecroft.* A Socialistic Novel. By Laon Ramsey. (London: William Reeves.)—We have classed these two books together as, probably, two of the worst novels it was ever our misfortune to be compelled to wade through. Wide as the poles asunder in some respects, they have this in common, that they are written in the most bombastic and inflated language possible, and the ordinary elements of human interest, incident, surprise, or plot are practically absent in both.

As Mr. Landon Deecroft is a Socialist, who wears "his black hair combed back over a finely-shaped head" (who does not recognise the blatant platform speaker with his hair combed back?), it is not surprising that he rants through whole pages and chapters of the book. Of course, this Socialist is a kind of angel on earth, while his partner, poor man, who has only worked and saved money, is exhibited as a mean and contemptible creature, because, apparently, he has an objection to lend his capital without interest. Those who can keep awake over the stilted maundering of Landon Deecroft, Annie Binham & Co. (we confess, in the most sacred confidence, that we could *not*), may learn how marvellously Mr. Deecroft's Communistic farm succeeded—on paper—in one of the Northern States of America.

In what grade of society the author of "Before I Began to Speak" has moved it would be exceedingly difficult to determine, so uncommonly vague are his ideas of the manners and customs of English ladies and gentlemen. We wonder who told him that a guest specially invited to a house to meet and thank a sick man could or would ever send up his card to him! Or, again, in what social rank it would be tolerated that people should break off a conversation to produce pocket-books or diaries, and read out Tupper-and-water by the yard! Why does not the writer of such stuff study Thackeray and Trollope, and learn how people in the position of his own puppets do act, and speak, and think?

National Lessons from the Life and Works of Carlyle. By Alfred Francison. (London: London Literary Society.)—Mr. Francison's "Lessons" consist in upwards of one hundred pages of sermonising; of, sooth to say, rather a dreary character. If we understand him (of which we are not overweeningly confident), he admires what Carlyle did, but not the motives which prompted him in doing it. Moreover, he is an admirer of that extremely self-assertive, not to say "bumptious," person, Mr. Ruskin. It is to be deplored that the acquaintance either of our author or of his compositor with the spelling of words not strictly English appears to be limited. Thus we find it asserted that "L'amour et la fumée ne peuve se *chacher*," the verb which we have italicised being as "the French of Stratford-atte-Bowe." Again, on p. 14, and again on p. 20, "Sart*us* resartus" appears, as do "magna char*ters*" on pp. 25 and 28. Might we further venture to hint that the famous poet spelt his name Shelley, and not "Shelly," as rendered by Mr. Francison on p. 39?

India Revisited. By Samuel Smith, M.P. Reprinted from the *Contemporary Review.* (London: Wm. Isbister. 1886.)—The man who is to discuss Indian affairs with any claim to attention should belong to no English political party. In the pamphlet before us Mr. Smith tries very hard to treat his theme in an impartial and judicial spirit, but it is abundantly evident that he has been sedulously crammed by the "Baboos," and sees the problems which await solution in our mighty Eastern empire almost wholly through the spectacles which those artless beings have provided for him. His remarks on the Drink traffic may, however, be read with advantage.

Euclid Revised. Books I. and II. By R. C. J. Nixon, M.A. Clarendon Press Series. (Oxford: Clarendon Press. 1886.)—Of all the attempts to improve the imperishable work of the mighty Alexandrian geometer, Mr. Nixon's appears to us to be the most successful. By the simplification of some of the methods of proof he is enabled to omit certain propositions altogether; although, in view of the omnipotent examiner, these are subsequently given at the end of each book. His addenda, exercises, and appendices are very notably good.

The Public School Chemistry. By J. H. Anderson, M.A. (London: Cassell & Co. 1886.)—Mr. Anderson well describes his book as "a syllabus for the master and an abstract for the boy." It is essentially one to teach from, and differs in this respect from the mass of elementary works in chemistry which are so abundant. The familiar pictures of the retort, the pneumatic trough, the spirit-lamp—*et id genus omne*—are wholly absent from its pages; in fact, it is intended to supplement and not replace the instruction given in class or at lecture. Its value for this purpose is undeniable.

We have also received from Messrs. Griffith, Farran, Okeden & Welsh *Pettitt's Shilling Folio Scribbling Diary*, *The Week*, and *Pettitt's Desk Remembrancer*, each in its way useful for noting current events, reminding their possessor of his appointments, &c. They are cheap, and well got up. From Messrs. Moffat & Paige we have *Digesting Returns into Summaries*, by E. J. Henchie and J. Hall, a Civil Service cram book; and six parts of the *Home Lesson Book to the New Explanatory Reader*, which seems well calculated to enable children attending Board and National schools to get up their lessons intelligently.

THE FACE OF THE SKY FOR MARCH.

By F.R.A.S.

THE persistent observer of the sun may be rewarded by the occasional view of spots, but they are becoming more infrequent, and a really fine one is a rare object. The zodiacal light may now be well seen after sunset in the west, as a blunt ill-defined cone of light, as bright as, or brighter than, the Milky Way. The night sky will be found depicted on map iii. of "The Stars in their Seasons." Minima of Algol ("The Stars in their Seasons," map i.), will occur at 11h. 43m. P.M. on the 2nd; 8h. 32m. P.M. on the 5th; 1h. 25m. A.M. on the 23rd; 10h. 14m. P.M. on the 25th; and 7h. 3m. P.M. on the 28th; and at other times where either the light of the sky or the inconvenience of the hour renders their observation difficult or impossible. Mercury is an evening star during the first half of March, and during the first week or so may be picked up with the naked eye just above the western horizon after sunset. He attains his greatest eastern elongation from the sun (18° 9′) on the 5th. Venus is an evening star, too, and may in like manner be seen in the west directly after sunset. She is just now a singularly uninteresting object for the observer with the telescope. Mars is invisible. Jupiter souths during the early morning hours, but he rises soon after half-past 10 o'clock at night at the beginning of March, and rather more than two hours sooner at the end of it. It will be found just above the star λ Virginis ("The Stars in their Seasons," map v.) by those who care to sit up, or get up, to observe him. The visible phenomena of his satellites occurring before 1 A.M. are necessarily few. Such of them, as (presupposing clear weather) may be certainly seen, are as follow: On the 5th, the ingress of the shadow of satellite I. on to the planet's disc will happen at 12h 9m. P.M. On the 6th, the same satellite will reappear from occultation at 12h. 38m. P.M. On the 11th, the shadow of satellite II. will pass off at 11h. 31m. P.M. On the 13th, satellite I. will disappear in eclipse at 11h. 25m. 1s. P.M. On the 14th, the egress of the shadow of satellite I. will occur at 10h 44m. P.M., followed at 11h. 32m. P.M. by that of the satellite casting it. Satellite III., which is also on Jupiter's face, will leave his limb at 11h. 38m. This phenomenon, for the reason so often given in this column, should be carefully watched. On the 18th, the ingress of the shadow of satellite II. will happen at 11h. 28m. P.M. On the 21st, the shadow of satellite I. will enter on to Jupiter's limb at 10h. 25m. P.M. At 10h. 38m. P.M. the shadow of satellite III. will follow it. At 11h. 7m. P.M. satellite I. itself will commence its transit across the planet. At 12h. 37m. the shadow of satellite I. will leave his opposite limb, as will the shadow of satellite III. six minutes later. On the 22nd, satellite I. will reappear from occultation at 10h. 36m. P.M. On the 27th, satellite II. will reappear from occultation at 11h 58m. P.M. On the 28th, the ingress of the shadow of satellite I. begins at 12h. 18m., as does that of the satellite casting it at 12h 52m. P.M. On the 29th, satellite I. will disappear in eclipse at 9h. 40m. 12s. P.M., to reappear from occultation 21 minutes after midnight. Lastly, satellite I. will pass off Jupiter's disc at 9h. 29m. P.M. on the 30th. Saturn is visible during the whole of the amateur's ordinary night, but is best seen about 8 P.M. or so. He will be found somewhat to the west and a little to the north of δ Geminorum ("The Stars in their Seasons," map ii.). He is, as always, a superb object in any telescope from $2\frac{3}{4}$ inches in aperture upwards. Uranus is now coming into a better position for the observer, and (notably towards the end of the month) may now be very fairly seen by midnight or even sooner. He may be picked up to the SSE. of γ Virginis, and identified by his pale-blue disc. Neptune is rapidly getting lost in the twilight. The Moon enters her first quarter at 1h. 7·8m. on the 3rd, is full at 8h. 33·9m. P.M. on the 9th, enters her last quarter at 1h. 42·1m. P.M. on the 16th, and is new at 4h. 9·7m. in the afternoon of the 21th. Nine occultations of fixed stars occur during the present month at convenient hours. The first happens on March 2, when Aldebaran will disappear at the Moon's dark limb at 5h. 47m. P.M., at an angle of 182° from her vertex, reappearing at 6h. 4m. P.M. at her bright limb at a vertical angle of 210°. On the 5th, a 6th magnitude star, *f* Geminorum, will disappear at the dark limb 41 minutes after midnight, at a vertical angle of 43°. It will emerge from behind the Moon after she has set. On the 8th, 45 Leonis, a 6th magnitude star, will disappear at the dark limb at 6h. 24m. P.M. at an angle from the Moon's vertex of 68°. It will reappear at her bright limb at 7h. 14m. P.M. at an angle of 185° from her vertex. Later on in the same night, ρ Leonis, of the 4th magnitude, will disappear at the dark limb at a vertical angle of 61° at 8h. 50m. P.M., to reappear at the bright limb at 9h. 54m. P.M. at an angle of 211° from the vertex. On the 27th, μ Ceti, also a star of the 4th magnitude, will disappear at the Moon's dark limb at 6h. 42m. P.M. at an angle from her vertex of 108°, and will reappear at her bright limb at 7h. 35m. P.M. at an angle of 359° from her vertex. On the 29th, θ^1 Tauri, of the $4\frac{1}{2}$th magnitude, will disappear at the dark limb at 9h. 17m. P.M. at a vertical angle of 117°, reappearing at the bright limb at 10h. 13m. P.M. at an angle of 335° from the Moon's vertex. At 9h. 26m. P.M., θ^2 Tauri, another $4\frac{1}{2}$th magnitude star, will disappear at the dark limb at an angle of 91° from the Moon's vertex. Its reappearance at the bright limb will occur five minutes sooner than that of θ^1, which was occulted before it. It will happen at an angle of 0°, or *at* the Moon's vertex. On the 29th, B.A.C. 1391, a star of the 5th magnitude will disappear at the dark limb at 10h. 16m. P.M. at a vertical angle of 159°, its reappearance at 11h. 7m. P.M. at the bright limb of the Moon occurring at a vertical angle of 288°. Lastly, on the 30th, 115 Tauri, a 6th magnitude star, will be occulted by the Moon's dark limb at 9 minutes after midnight, at an angle of 173° from her vertex, but she will have set ere it reappears. At noon to-day the Moon is in Taurus, through which constellation she is travelling until 3h. A.M. on the 4th, when she arrives at the western edge of the narrow northern prolongation of Orion ("The Seasons Pictured," plate xxiii.). It takes her 12 hours to cross this, and at 3 o'clock in the afternoon of the same day she emerges in Gemini ("The Seasons Pictured," plate xxiv.). Her passage across Gemini occupies her until 7h. A.M. on the 6th, when she quits it for Cancer. She remains in Cancer until 5h. 30m. P.M. on the 7th, when she enters Leo. Her journey through Leo is completed by 2h. A.M. on the 10th, at which hour she crosses into Virgo ("The Seasons Pictured," plate xxv.). She quits Virgo in turn for Libra at 9h. P.M. on the 12th ("The Seasons Pictured," plate xxvi.). In the course of her passage over Libra, she arrives at 4h. P.M. on the 14th on the confines of the narrow northern strip of Scorpio; and when 9 hours later she has traversed this, it is to pass out at its eastern edge into Ophiuchus. She quits Ophiuchus and enters Sagittarius at 5h. P.M. on the 16th, and Sagittarius in turn for Capricornus at 6h. A.M. on the 19th ("The Seasons Pictured," plate xxi.). At 4h. P.M. on the 20th she passes into Aquarius. Here she remains until 3h. P.M. on the 23rd, when she enters Pisces ("The Seasons Pictured," plate xxii.). She is travelling through Pisces until 6h. 30m. P.M. on the 26th, at which hour she arrives at the northern outlier of Cetus. Before noon the next day she has passed out of this into Aries. At 2h. P.M. on the 28th she leaves Aries for Taurus ("The Seasons Pictured," plate xxiii.), and at 10h. A.M. on the 31st arrives, as at the beginning of the month, on the western boundary of the northern prolongation of Orion. She remains in this for about 12 hours and a half, and then leaves it for Gemini ("The Seasons Pictured," plate xxiv.). She is, of course, in Gemini at midnight on the 31st.

Our Whist Column.

By "Five of Clubs."

MATHEWS ON WHIST.

(*Continued from* page 71.)

It is better to lead from a suit headed by Ace, nine, than from one headed by Ace, ten; since in the latter case you are more likely to have a tenace if the suit is led by the adversary. [Modern whist would hardly countenance a choice in leading determined by such a consideration as this.]

Many good players, in leading from tierce major, begin with the King and Queen. [It is now the customary rule to do so.] This is often productive of mischief; as when [King is] played at other times from King and Queen only [that is, King and Queen with small ones, but without the Ace], the Ace may be kept up; and while each thinks his partner has it and has played accordingly, it unexpectedly appears from the adversary and disappoints their whole plan. [The reasoning here seems unworthy of so skilful a player as Mathews.] If a player leads King from tierce major, he follows immediately with Queen, unless he betakes himself to trumps, fearing a ruff. Now, on the other hand, if having led King from King, Queen, and another, he is in doubt whether the Ace lies with his partner or not, he may change suit. But it is only when he has led from King, Queen, without the Ace, that he would change to another plain suit. Doubt then can scarcely ever arise. Moreover, if in doubt whether partner holds the Ace or not (and it is seldom good play for either adversary to hold the Ace if he has it, though some of the over-clever often do it), it is best to go on with the suit, leading a small one, since the chances are in favour of bringing out the Ace this second round. In any case, the lead of King followed by Queen indicates unmistakably that you hold the Ace also.

From King, Queen, Knave, as from all high tierces, the highest is led, except that with two small ones or more the Knave should be led [to draw the Ace from your partner if he has it.]

From King, Queen, ten, in all suits lead the King; but if it passes do not pursue the lead, ascertain the Ace is in your partner's hand: for it may be kept up: but change your lead, and wait for the return of your partner—when you have the finesse of the ten if necessary.

This is no longer considered good Whist. It is nearly always better to go on with a small card than to change suit. All good players put the Ace on the King, led by an adversary, in nine cases at least out of ten. The chances are so great if your King is passed that either your partner holds the Ace or that you can do no harm by going on with the suit, that it is contrary to sound Whist policy to incur the almost certain mischief arising from a change of suit, on account of the minute chance that going on may do harm.

From King, Queen, four others, or fewer, lead the King always in plain suits, unless you hold the two last trumps, when you may [safely] play a small one. [It is not easy to see what you gain by so doing, whether the Ace lies with the enemy or with your partner. For with the two low trumps you are sure to get the lead as soon as you need it.] In trumps, lead the lowest [*generally*]. With King, Queen, and five others, the King should be led in all suits.

From King, Knave, ten, &c., in all suits, lead the ten. From King, Knave, and two or more small ones, lead the lowest.

[From King, Knave, and one small one, lead only if it is clearly your partner's suit, in which case lead King, and if it passes continue with Knave.]

[From Queen, Knave, ten, &c., lead the highest, in all suits.] From Queen, Knave, nine, and others, lead the Queen. [This is no longer approved, except sometimes late in the hand, when it is seen that the game can only be made or saved by the successful finesse of the nine.] From Queen, Knave, with two more, lead the lowest. From Queen, Knave, one other, lead the Queen. From Queen, ten, two others the lowest; [if with one other, do not open the suit unless sure it is your partner's, in which case lead Queen, and if it makes follow with ten.] With Queen and three small ones, lead the lowest. From Queen, with only two, lead [if at all] the Queen [but to do this you should have reason to think that it is your partner's suit.]

[From Knave, ten, nine, &c., lead Knave; from Knave, ten, and small ones, lead the lowest; but with only one small one the Knave. From Knave, three or more small ones lead the lowest; but with only two small ones besides the Knave, lead [if at all] the Knave.]

[Ten may be led from ten, nine, eight, and two or more small ones, but it is not a satisfactory opening, and seems only justified by a good chance of establishing and bringing in the suit. From ten, nine, and a small one, or ten, two small ones, lead ten.] In general, the lead of a ten indicates either a sequence to the King, King, Knave, ten, and another, or that the ten is the best of a weak suit.

Nine is never led by good players from a head sequence of three [though if there is great length in the suit, and trump strength, the lead may be justified]. In general, the lead of a nine indicates either—

1. A sequence up to the King.
2. King, Knave, ten, nine, with or without others not in sequence with the nine.
3. A weak suit, not more than three in number, the nine being the best.

If, when ten or nine is led by your partner, you hold either King or Knave in your own hand, you are certain the lead is from weakness, and that the whole strength of the suit [outside your own hand] is with the adversary, and play accordingly. [The inference is equally obvious if the lead of ten or nine is from either adversary, and you hold either King or Knave.]

To lead from only three cards, unless in sequence, is bad play, and only proper when you have reason to think it is your partner's suit, in which case play off the highest, even if the King or Queen.

[With Ace or King, or Queen or Knave, and one other, if you lead, which you will only do when you have reason to think the suit is your partner's, invariably lead the highest, except, of course, towards the close of a hand when you may have obtained such knowledge of the position of the cards that plain strategic reasons, as clearly recognised as in Double Dummy, show that the small one should be led. Such exceptions as these, however, are not considered in discussing general rules for leading.]

It is highly necessary to be correct in leads. When a good player leads an eight and then a seven, I know he leads from a weak suit; the contrary when he plays the seven first. It is the same even with a tray and a deuce. This is what bad players always err in, as they never can see the difference. [Of course these considerations do not apply in the same exact sense to modern play, though the necessity of correctness on the part of the leader and attention on the part of partner, as well as attention to the play of the adversaries also, remains, or is even increased. The lead of an eight, now, followed by a seven, would mean that the leader had originally five cards of the suit. Unless, indeed, a player boldly rejects the penultimate lead and its "fourth best" devel pment, and stands on the ancient ways. For any good the penultimate and fourth best leads do ordinary players, these conventions are but a poor set-off for the loss of the valuable old method for distinguishing between weak leads and strong leads.]

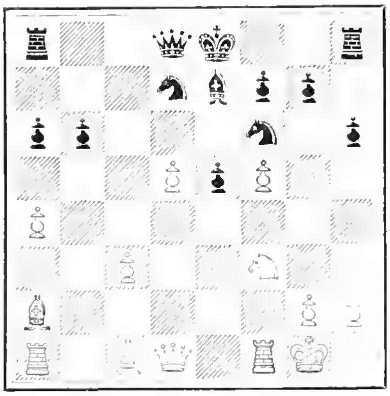
(*To be continued.*)

Our Chess Column.

By "Mephisto."

END-GAMES FROM ACTUAL PLAY.

Black.



White.

J. GUNSBERG.

White won the game in the following manner:

19. P to Q6	19. B to Bsq.
20. B to R3	20. P to QKt4

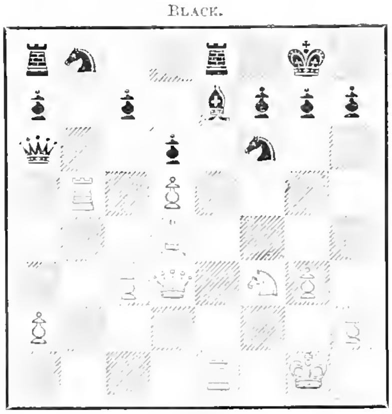
With the idea of checking with Q to Kt3, to make room for the King.

21. R to Ksq.	21. P to K5.

It would have been better to play Q to Kt3 (ch) first. Black did not see the impending disaster.

22. R × P (ch) !	22. Kt × R
23. B × P (ch) !	23. K × B
24. Q to Q5 (ch)	24. K to Ksq.
25. Q to K6 (ch)	25. B to K2
26. Q to Kt6 (ch)	26. K to Bsq.
27. P × B (ch), and wins.	

Black.



White.

S. TINSLEY.

White proceeded in this elegant style:

20. R × B !

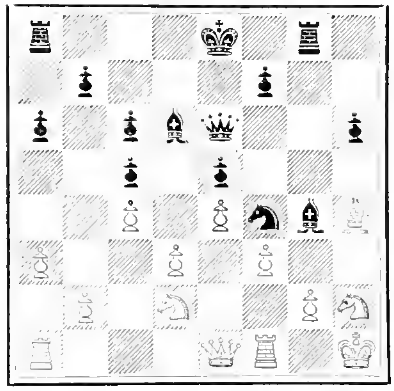
If Black retakes this Rook he loses his Queen.

	20. P to B3
21. B × Kt !	21. Kt to Q2 ?
22. R to Kt8 ! and White won.	

Awfully good.

J. GUNSBERG.

Black.



White.

A very singular ending, in which Black continued with—

20. B to R6

Bold. Promises to become a paying investment.

21. P × B	21. Q × P
22. R to KKtsq	22. R to Kt7 !
23. B to Kt3	23. Kt × P
24. Q to K3	24. Kt to B4

Every move is of great interest. Black might have won the white Queen by Kt to B7 (ch), but evidently he prefers to play for a mate.

25. QKt to Bsq	25. Castles
26. R to Qsq	26. R to Ktsq !

This whole ending forms a useful study.

27. R to Q2	27. R(Ktsq) × B
28. QR × R	28. R × R
29. P to Kt4	

White has no move, as none of his pieces can play.

29. B to K2 !

Comes round at his own sweet will.

30. P × P	30. B to R5
31. P to R4	31. B to Kt6

Resigns.

PROBLEM BY MR. PROCTOR (p. 95, February).

Position.

White K on KB8. B's on K5 and QKt3. Kt's on Q5 and QR7. P's on Q3, Q6, QB2, QR5 (9 pieces).

Black K on QB4. P's on KKt5, Q2, Q5, QB6, QKt4, QR3 (7 pieces), 3 moves.

Solution.

1. B to Kt3	1. P to Kt5
2. Kt to B4	2. K × P
3. Kt to K6 mate.	

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THE COMPLEXITY OF THINGS.

By Grant Allen.

ONE of the feelings which most grows upon the scientific observer, as his knowledge of the world in which his life is cast gradually increases, is a profound and abiding sense of the infinite interaction of cause and effect, the immense and immeasurable complexity of things in this universe. Glib ignorance is always ready with an easy explanation or a hasty prophecy; mature experience distrusts more and more from day to day its own power of prognostication, or even of analysis. Look, for example, at the readiness with which the local weather prophet will confidently assert that we are going to have a hard winter or a late spring. Upon what endless interrelations of causes and events, all the world over, does the weather of an English season depend! What knowledge of the ice packs in the Arctic regions, of the bergs that float and melt in the Atlantic currents, of the depth of snow on the Siberian plains, of the strength and direction of the Gulf Stream and its divergent branches, of the prevalent conditions in Sahara, Spain, and the Mediterranean, is necessary in order adequately to forecast the British weather for the next twenty-four hours! An east wind, blowing over the frozen plains of Central Europe, brings us frost and ice and sunshine to-day; a westerly breeze, fresh from the warmer currents of the Gulf, brings us cloud and rain and thaw to-morrow. Our fruit-trees have their blossoms nipped in the flowering season, because great blocks of glacier have disengaged themselves prematurely from the melting cliffs of the Greenland ice-sheet; our strawberries ripen in good time because a change in the distribution of atmospheric pressure causes a downward current of heated air to set in towards Britain from the African desert. Why is the west wind so unwontedly bitter to day? Because there are ice-floes off the coast of Labrador. Why does the fog hang heavy over London this morning? Because a certain motionless state of air prevails over Western Europe, from Hammerfest to Lisbon. Why did our pears fail to set their fruit? Because of the early spring in North-Eastern America. Why did our roses get nipped by the frost? Because of the clear weather over the Hindu Koosh and the valley of the Lena. Mr. Robert Scott, enthroned in the Meteorological Office in London, with constant telegrams informing him from moment to moment of every fluctuation in barometric readings at Valentia or Bayonne, every rise of temperature in the Bay of Biscay or the North of Scotland, every shower of rain off the Norwegian Islands, every passing thunderstorm in Auvergne or Dalecarlia, can scarcely prognosticate the coming weather for twenty-four hours in advance with any approach to probability. Yet the local weather prophet, unabashed by his utter ignorance of the conditions of the entire problem, will predict the weather of a whole season as confidently as though he held all the threads in his own hands, and directed the winds and waves irresponsibly from an easy-chair in his own drawing-room.

What would be the effect upon the climate of Western Europe if we were to turn Sahara into an inland sea? What would be the result upon the world's weather if we were to cut a large outlet for the heated waters of the Caribbean Sea through the Isthmus of Panama? Most people are prepared at a moment's notice to dogmatise freely as to what would happen in either of these extreme and improbable cases. They will say offhand that the flooding of Sahara would improve the climate of North Africa generally, and that the diversion of the Gulf Stream would reduce Scandinavia and Britain to the respective conditions of Greenland and Manitoba. But how infinitely complex is each such problem! Who shall say what changes might be induced, when Sahara was flooded, by the alteration in the hot, dry winds which now blow off the wide expanse of desert? What melting-effects do they ultimately produce upon the ice and snow of the Spanish Sierras, the Pyrenees, the Alps, and the Carpathians? What extra growth of glaciers would descend, in their absence, upon the plains and valleys of Castile, of Languedoc, of Switzerland, and of Lombardy? What varieties would these, again, induce in the Föhn, in the Bora, in the Mistral, in the Tramontana? Every variation in the amount of moisture due to evaporation will give rise to changes in rainfall, in snow, in ice, in glaciers; will produce new phenomena of denudation, of river forming, of earth sculpture, of local climate; and will therefore react at last upon vegetation, upon fauna, upon agriculture, and upon human life and industry in general. More seas in Africa might mean more rain and snow and ice on Atlas; more cooling of the air in Southern Europe as a whole; more accumulation of glaciers over all the mountain ranges of our peninsular area; in short, a complete upsetting of the climatic balance in this quarter of the world as we actually know it. But I do not say it would necessarily do so. I do not wish to dogmatise. On the contrary, I believe the complexity of these problems surpasses existing human powers of combination. It is impossible to keep all the factors of so vast a sum always before one's mind in the act of computation. When one reads speculations like Dr. Croll's or Mr. Alfred Russel Wallace's the mind is carried away for the moment by their sustained reasoning: it seems all as clear as day; the glacial epoch was doubtless due to the earth's eccentricity, and if we could once melt off the Polar ice-cap, subtropical vegetation might once more spread to the frozen shores of Spitzbergen and Alaska. But when we come, on the other hand, to read such a book as Professor Mohn's "Météorologie" we feel as though the problems of our existing climate even were far too complex for human solution.

Let me give a single instance in illustration of the difficulty of predicting the effect upon climate or earth-sculpture of local changes. In a small town in the West of England the cliffs were being rapidly washed away by the sea. Groynes were erected along the beach, but where they terminated the current formed a scour, and, eating away the cliff worse than ever at the end, began to attack the town by a flank movement. So an eminent engineer was called in to advise the Corporation as to the erection of a breakwater. The eminent engineer, after duly inspecting the bay and cliffs, reported that to erect a breakwater on ledges of rock in the neighbourhood would be comparatively easy, but when erected it might produce either of two effects with equal probability. It might protect the menaced cliffs, or it might set up special eddies which would wash away the town faster than ever. The Corporation, thus advised, dropped the breakwater, and preferred to leave themselves in the hands of Nature. Indeed, on an open line of coast, exposed to varying winds and diverse currents, it is almost impossible to say beforehand what will be the effect under all circumstances of any given change of contour in projecting portions.

Look for a moment at another case familiar to everybody who owns a garden. How infinite are the diversities of soil and climate and situation within a single little patch of a quarter of an acre! Here, the snow lies long; there, the radiation from a wall melts it rapidly; yonder, again, the drifting due to eddies caused by the neighbouring palings ridges it up into a low mound, which resists for many days together the melting effects of the sun and of the warm westerly breezes. Round this corner here the wind whistles so fiercely that not even spruce firs will thrive and flourish; on the opposite side the house gives shelter from the cold east winds, and sub-tropical annuals—like the castor-oil plant—will grow vigorously from seed in a sunny exposure. At one point the dripping from the roof waterlogs the grass; at another, too rapid drainage through the sandstone soil allows it to dry up and wither, unless constantly moistened by the garden hose. The shade of the Portugal laurels interferes with the free development of the scarlet anemones; the hyacinths, at this end of the bed, are later by a week than their sisters at that end, because the shadow of a tall poplar wheels over them for three hours daily, intercepting their due share of the morning sun. One's own little garden, in fact, is a petty epitome of all the facts of climate in the world, too complex for the most diligent observer and reasoner ever fully to comprehend its minute diversities. The mound of snow where the children made the snow-man, which lasted unmelted after a fortnight's thaw, represents in miniature the Alps and the Himalayas, or the obstinate Polar ice-cap itself. There are windy corners and sheltered nooks, inexplicable patches where the grass will never grow on the lawn, spots where the wall-flowers blossom in February, and spots where they linger till late in June. When I look at the endless complexity of the square mile that lies around my own house, at the diversity of flora on the two sides of the road that runs through Milton Heath, at the differences caused by the northern and southern aspect of the round barrow on the hilltop, at the climatic varieties of chalk and greensand and weald clay, with their accompanying peculiarities of fauna and flora, I am appalled at the temerity of men who will dogmatise freely about the causes of mild arctic climates, or the effects of drying up the Atlantic Ocean. Why, a complete account of the causes which lead to the climate of a single house from day to day would baffle the wisest meteorologist in Europe. The thermometer just now in this very room stood at 56° beside the bookcase when it was 61° on the centre table. A removal to a position two feet higher on the sideboard sent it up a couple of degrees. Put your finger to the key-hole when the door is shut, and feel the cool air rushing in, in a jet, like water through the cracks in a floodgate, and you can faintly realise the turmoil and commotion of the atmosphere of the place in which you are now sitting. If you could see it coloured, so as to make the movements visible, you would find it a theatre of endless eddies and currents, of actions and reactions marvellous and innumerable—heated air flowing up the chimney; cold air to replace it rushing in at the cracks of the doors and windows; carbonic acid from your breath falling to the floor; aqueous vapour floating idly about in little dispersed clouds and flocculi; heated gases ascending to the ceiling; everywhere whirls and curls and rigmaroles, dancing and eddying in a perpetual vortex. Our human habit is to reduce every problem too much to naked simplicity. The concrete world in which we live consists, on the contrary, of infinitely complex interactions of cause and effect, which it is well-nigh impossible for us adequately to disentangle one from the other.

PRIZE COMPETITIONS.

By Richard A. Proctor.

I KNOW no more amusing development of modern journalism than the system of Prize Competitions, by which the time-wasting idiots who formerly struggled for fame by solving the imbecilities called acrostics are now invited to decide who are the greatest statesmen, poets, philosophers, painters, of such and such nations or times, and which the greatest of their works. (I have called the acrostic-solvers wasters of time; but on second thoughts I withdraw the remark: *their* time could hardly be wasted.) Of course we know beforehand that, in struggling for the prizes in the more recent competitions, these folk carefully avoid any attempt to judge for themselves. What they try to do is to guess who are likely to be generally selected as greatest in the several departments dealt with, and by choosing those to secure the best chance of the prizes doled out to them by the proprietors of papers employing this clever dodge for checking loss of circulation. Still, although for this reason the system is not really so outrageously absurd as it seems to be on the face of it, yet even the appearance of weighing the opinions of those who necessarily have no judgment is an absurdity which cannot but degrade journalism.

Imagine, for example, a score of the foolish folk who had been successful in solving acrostics according to their "lights" (the acrostics' lights, I mean) attempting to decide, from their own knowledge, on the twelve greatest poems in the English language! Even the average opinion of the community would decide wrong on such a subject as this; and these strange beings must be altogether below the average, or they would never be found among the acrostic-solvers. We know that to untrained minds, which is the same as saying to the majority, a Tupper or a Robert Montgomery seems a greater poet than a Shakespeare or a Milton—until some one shows them the absurdity of what they have mistaken for sublimity. We only have to note what such minds turn to naturally, and would continue to admire, were they not corrected, to see that this is the case—though, indeed, it is simply what might be expected. Consider the sale which Tupper's "Proverbial Philosophy" obtained during about a quarter of a century, despite its utterly prosaic and commonplace character! Or recall the way in which the bulk of the community accepted the ruined plagiarisms and ungrammatical idiocies of Robert Montgomery as poetry, equalling, if not surpassing, Milton's best! Even Macaulay's crushing criticism in the *Edinburgh Review* did not kill Robert Montgomery at once. ("Breaking a butterfly on the wheel," some called Macaulay's criticism; but crushing a cockroach would be nearer the mark.) I remember well how his pretentious absurdities were selected for reading by enthusiastic admirers as late as a score of years after Macaulay's review should have taught even the silliest of Montgomery's admirers what tawdry tinsellings they had mistaken for real poetry.

Imagine folk compared with whom the admirers of Tupper and Montgomery were excellent judges invited to pronounce on the merits of Chaucer and Spenser, Shakespeare and Milton, Dryden and Pope, Wordsworth, Coleridge, Scott, Byron, Browning, and Tennyson! Conceive such self-convicted imbeciles as the acrostic-solvers pretending to decide between Scott and Thackeray, George Eliot and Georges Sand, Charles Reade, Bulwer Lytton, and Dickens. If they spoke their real minds we know they would pronounce for Ouida, or for the novelists of the *Family Herald* and the *London Journal*. Ask some draper's assistant or grocer's lad, whose real taste is for tales of highwaymen, what he thinks of Christie Murray's "Aunt Rachel" as compared with "Redhand the Rover"; ask 'Arry or 'Arriet whether a study of street life by Murillo or a brilliant chromo of "Lancer and Vivandière" is most to be admired. You would certainly get a reply saying little in favour of Murray's charming idyll or Murillo's masterpiece of *genre*. But such a decision would be wisdom itself compared with the real opinion of acrostic-solvers, if only they would give it on questions of philosophy or statesmanship, poetry or fiction, art or music, science or religion.

It is worthy of remark, not to notice further the self-proclaimed imbecility of acrostic-solvers *et id genus omne*, that the opinions of majorities on all questions of difficulty are almost certain to be wrong, if really independent—nay, absolutely certain to be wrong. Such opinions never are independent, so that it can do no harm to indicate the certainty of the wrong decision of most men when really judging for themselves. The world at large accepts its great men (generally after death) on trust, and adopts their ideas on the assumption that they are probably right. If we had to wait till the majority independently adopted correct ideas we should have to wait long enough. In science we should still regard the earth as flat and the moon as ruling the weather; the elements as four only: the sun, moon, and stars as meant chiefly for signs, and comets for portents. In politics and religion I know not what follies men would believe in, other than those at present in vogue: for men do not accept political and religious ideas on trust from the wiser, but form their own opinions, and so illustrate my thesis more effectively than satisfactorily. In poetry and fiction, in music and in painting, the prevalent ideas would be semi-savage indeed did not the majority take their opinions chiefly from those who know.

Putting the matter as one of probabilities, we see that it cannot be otherwise. Let a hundred average members of even the most cultured community give their independent opinions on some question of difficulty—not of such extreme difficulty as, for example, the nature of Deity, or a future life, but of moderate difficulty, as the principle of hereditary legislation, the value of colonies and conquered countries, or the like. The chance that any one of the hundred gives a just opinion, independently, on such a question is much exaggerated when it is set as one in ten (one in a million would be an exaggerated estimate for the extremely difficult questions first mentioned). Assuming, however, even so unlikely a chance of a right opinion as this, what chance would there be that a majority of the hundred would decide rightly? The same chance that there would be of drawing more than fifty white balls at random from a hundred vases, each containing ten balls, one only of which is white—one drawing only being made from each vase. Calculating this chance, we find the odds against the majority deciding rightly (unless trusting in the judgment of their best teachers) to be millions of millions of millions to one.

The value of the much-vaunted argument from common consent can thus be imagined. Unless a question is one so simple that every one is almost sure to judge rightly, common consent, if it means anything at all, means the practical certainty of common error. Fortunately, it means generally nothing more than the common agreement of most men to accept the opinion which they suppose to be approved by the wiser sort. Yet, even as thus modified, or practically nullified, the opinion of the majority will be wrong ninety and nine times before, on the hundredth trial, it gets right by force of sheer compulsion—and hitherto in the world's history *common consent* has *never* reached the truth in any matter of difficulty.

THE JUNIORITY OF BEASTS:

FURTHER REMARKS ON THIS AND KINDRED OF THE CONTENTIONS OF MR. GLADSTONE.

By Oswald Dawson.

I MUST thank Mr. Edward Clodd for his kindly mention of my previous note on this subject. *After* forwarding it * to Knowledge I read the footnote to which he refers, running thus: "The discovery of the lowest mammalian forms in earlier strata than those containing birds seems opposed to the accepted order of succession, but there is considerable uncertainty as to the exact period of the first appearance of birds." Hereupon Mr. Clodd founds an agreement with me. Having to thank Mr. Clodd for a series of really entertaining articles on "The Story of Creation," it would indeed be ungracious to find fault if a well-intentioned footnote of three lines happen to be ill expressed. Excuse for renewing the subject is to be sought in the circumstance that Mr. Gladstone has contributed to the current issue of the *Nineteenth Century* (August) a brief reply † to Professor Huxley's valedictory surrejoinder.

The succession of organic groups was the chief topic of discussion between these gentlemen, and as the issue of this "tournament, which, whether one regards the dignity of the combatants or the gravity and delicacy of the cause, it is not possible to await without the keenest interest," has not anywhere been concisely stated, an article, in some measure a *résumé*, may be acceptable.

The Juniority of Animals as against Plants.—According to Genesis, plants were formed a day before the dawn of animal life; if, as according to Mr. Gladstone, the creation of what are translated whales did really herald that dawn. If cetaceans were in question there would be no discrepancy, as whales probably do not ante-date tertiary times; ‡ but when we read "fishes" in lieu of "whales," as Mr. Gladstone bids us, the evidence from fossils compels us to regard it as very far from a "demonstrated conclusion and established fact" that these animals were created subsequently to the evolution of the higher flora, inasmuch as indubitable remains of fishes of a high order § are found in upper silurian rocks—

* Before March 26. On that date I sent a note requesting the deletion of the words "authority, or at any rate author," as applied to the late Professor Oscar Schmidt. The editor was perhaps on the Continent at this date.

† In the shape of a letter affirming Professor James D. Dana's agreement with Mr. Gladstone on essential points. In the treatise under discussion (*Manual of Geology*, p. 847) Professor Dana emphasises by italics the two following axioms: "This document, if true, is of divine origin." "If divine, the account must bear marks of human imperfection, since it was communicated through man." The former view is answered in the *Westminster Review* (January 1886). The latter—applicable, perhaps, when adapted by spiritualists to account for any hybrid character conspicuous in trance-orations—is not self-evident in the case of divine writings.

‡ The occurrence of *Palæocetus Sedgwickii* in strata of Jurassic age (*v.* Seeley, *Geol. Mag.*, Feb. '65) is accountable otherwise than by assuming that the creature lived at that date (*v.* Owen, *Brit. Foss. Mam. and Birds*, pp. xv. and 520, and *Pal.* p. 321).

§ The *Ganoidei*. In *Onchus* and the "Conodonts" it may be we have representatives of two other orders.

a fact involving a high antiquity for the class. So that even were the high claims of certain palæozoic plants established, their seniority as against fishes would not be demonstrated, nor yet rendered probable.

The Juniority of Fishes as against Birds.—This is, of course, a scientific fact. Genesis, however, does not expressly teach it. Both classes were created on the fifth day. "One is necessarily mentioned before the other." (*West. Rev.* as above.)

The Juniority of Reptiles as against Beasts.—This juniority is probable. Professor Huxley never asserted it, as Mr. Gladstone supposes. Nor does Genesis assert so. It seems rather to teach their contemporary origin on the sixth day. Had Mr. Gladstone contended for this, however, or for their origin before beasts during an earlier part of the sixth day, the prior existence of birds on the fifth day would have had to be explained away. The reptiles, however, are submitted to this process instead; in a manner, too, which it has been said would have excited the envy of Artemus Ward. "Reptiles were a family fallen from greatness; instead of stamping on a great period of life its leading character, they merely skulked upon the earth." Mr. Gladstone "would also hold by his previous remark" as to mistranslation and "the general structure and effect of the Mosaic statement," advancing illustrations; these being—(1) that the LXX. represent reptiles "as a sort of appendage to mammals" in a more conspicuous manner than do our versions; (2) "in the Song of the Three Children, where the four principal orders are recited after the series in Genesis, reptiles are dropped altogether, which suggests either that the present text is unsound, or, perhaps more probably, that they were deemed a secondary and insignificant part of it.

Professor Huxley replies thus: "I have every respect for the singer of the Song of the Three Children (whoever he may have been) . . . nor do I venture to doubt that the inconvenient intrusion of these contemptible reptiles . . . into an apologetic argument, which otherwise would run quite smoothly [!], is in every way to be deprecated. Still the wretched creatures stand there, importunately demanding notice." Unless Mr. Gladstone insists that the text being unsound, the terms "creeping thing" and "everything that creepeth upon the earth" mean other than reptiles, or ought to be dropped altogether, the justice of Professor Huxley's demand must be admitted. As to the other argument, the skulking in a day or two late of a class which *did* stamp upon the mesozoic age its leading character—and one member of which played an important *rôle* in the event which immediately succeeds the creation, to say nothing of later occasions, or of the notices taken of other members of the class—was certainly no fault of its own, and it is difficult to imagine what of poetry, or of intelligibility, or of brevity, or of aught else, would have been sacrificed had fowl been formed on the sixth day, and creeping things on the fifth, instead of *vice versâ*. According to some authorities, however, the reptilian class *was* represented before the sixth day.*

* "T*e*NIN*e*M: Dr. Lightfoot reads this as 'Amphibia,' and makes it include 'crocodiles, hippopotamets,' &c. . . . Parkhurst says the words seem to include both 'the crocodile and whale species.' Bishop Patrick holds the same view. The word translated 'great whales' in verse 21 is the plural of the same word which becomes 'a serpent' in Exodus vii. 9."—*Genesis, its Authorship and Authenticity*, by Charles Bradlaugh, third edition, 1882, p. 69, "International Library of Science and Freethought." "*Tanninim*, that is, crocodiles."—Principal Sir J. W. Dawson, *Expositor*, April 1886. "*Remes*, 'creeping things' . . . may here be taken to represent the smaller quadrupeds of the land."—Dawson, *Idem*, or "prowling" things.—Dana, *Op. cit.* Dr. Fr. H. Reusch, whom Mr. Gladstone modestly recommended to M. Albert Réville as a fitter representative of the reconciliation schools than himself, is antagonistic to Mr. Gladstone's reconciliation theories, at any rate, so far as the topics here under discussion are concerned. See *Nature and the Bible*, opportunely translated by Kathleen Lyttelton, vol. i, pp. 100, 356.

The Juniority of Beasts as against Birds.—Mr. Gladstone made a remark indicating his suspicion lest some one should score a point against him by "taking only birds of a very high formation," and not reckoning with *Archæopteryx*, *Hesperornis*, &c., as Mr. Gladstone himself did—a method in striking contrast to that employed by him when dealing with beasts; for birds in the "fourfold order" include fossil types, but as to mammals, said Mr. Gladstone, "I wish to be understood as speaking here of the higher or ordinary mammals, which alone I assume to have been known to the Mosaic writer," though why Moses should have known of *Archæopteryx*, but not of *Microlestes*, Mr. Gladstone does not explain. If this be consistent procedure, the objections I raised when misled by a *lapsus scribendi* of Mr. Clodd's were answered in anticipation. I then mentioned that Professor Huxley's only challenge to this portion of the fourfold order, if challenge it was meant to be, was the remark that "the question of the exact meaning of 'higher' and 'ordinary' in the case of mammals opens up the prospect of a hopeful logomachy." Having taken the matter in hand, however, "I must presume to animadvert with considerable freedom upon" Mr. Gladstone's (to borrow his phraseology) "mode of dealing with authorities."

We have the declaration that Professor H. G. Seeley supplies us "very clearly" with the place of birds in the succession of animal life—*i.e.*, as antedating mammals. The Manual is mentioned and the pages specified. Turning thereto, or to any of the other pages, no such view is enunciated, "clearly" or otherwise. Indeed, what we do read is that "geological history does not carry us back appreciably towards the origins of the great groups of organic nature." "There is evolution, but it is only the evolution of genera and of ordinal groups, and not of classes." Mr. Gladstone has also perused the statements and diagrams of the Phillips-Etheridge portion of the Manual, but these are confessedly of no avail for the present purpose.

Next comes Professor Prestwich's treatise, to the proofs of which Mr. Gladstone had access. Volume I. is now published, and it is to this that Mr. Gladstone referred, mentioning in particular two pages, and discovering here an order of succession which places birds as before beasts. This I fail to find on the pages specified or elsewhere. In the table of contents, however, birds do happen to be enumerated before mammals.

Then follows a postscript reference to the *Odontonithes* by Professor O. C. Marsh, to indicate the probability that the first "bird" was palæozoic. It is perfectly true that Professor Marsh has expressed this opinion, in *Odontonithes* and elsewhere. "For the primal forms of the bird-type we must evidently look to the palæozoic; and in the rich land fauna of our American *permian* we may yet hope to find the remains of both birds *and mammals*" (italics mine). This hope as to the turning up of permian mammals has perhaps escaped Mr. Gladstone's notice; or he might have hesitated to seek an ally in Professor Marsh, as being one liable to "prove too much."

Professor Marsh has, further, expressed the opinion that volant birds may have originated in triassic times—apparently solely on the ground that a (more or less) volant bird (*Archæopteryx*) occurs in the formation above, for he discredits altogether the avian character of the footprints—a method of reasoning which clearly compels us to promptly seek for the ancestors of the triassic mammalia in, at the latest, permian strata. This opinion, therefore, is detrimental to Mr. Gladstone's cause, and is so whether we "describe animals by *habitat*" or by structure."* In fact this description by *habitat* profiteth nothing. Carl Vogt compares the flight of *Archæopteryx* in some measure with that of *Galeopithecus*. The precise character of its sternum is not yet decided. It is very questionable, however, whether Moses, if inspired to inform us that bird-life commenced a day before beast-life, would have described it (we may ignore Professor Marsh's highly-problematically-avian permian parent of a hypothetically-volant absolutely-unknown triassic progenitor of the dubiously-carinate *Archæopteryx*), as "fowl that may fly above the earth in the open firmament of heaven;" or whether Mr. Gladstone would speak of such creatures as members of the "air-population." Moses had *better* have written of the feathered tribes!

Finally, let us bear this in mind. Had Mr. Gladstone judiciously abstained from referring to the Manual, the treatise, and the monograph, and ignored *Archæopteryx* and its undiscovered avian ancestors as he ignores *Microlestes*, though the logic of his advocacy might have been enhanced in merit, his case would none the less have failed, it being far from a "demonstrated conclusion and established fact of natural science" that "fowl that fly above the earth in the open firmament of heaven" were in existence a day, or an hour, before the advent of the *Eutheria*—whom we will venture to identify with "the higher or ordinary mammals."

The Juniority of Man as against Mammals.—Mr. Gladstone wants to know how the juniority of man comes to be set down in Genesis i. Prof. Huxley is supposed to have affirmed as probable that man came last of all animal species. The singularity of Mr. Gladstone's inquiry consists in the fact that he has taken scrupulous care to explain and insist that the Mosaic mention of a class on a particular day referred only to *some* members of that class. Seeing, as he thought, an opportunity to interpret Genesis literally for once, the delusion that every species of beast had been fully evolved before man's creation is eagerly seized upon. Of course beast-life commenced before the human period, but this degree of concordance is now too meagre. In fact, Mr. Gladstone has one rule for birds as a class, and one rule for beasts as a class; also, as we previously saw, one rule for *Archæopteryx*, another for *Microlestes*.

All I have to add to this section of the controversy is the remark that, unless we accept some such theory as that of Mr. S. E. B. Bouverie-Pusey (in *Permanence and Evolution*), avowedly arrived at by guessing, that evolution operated until a recent geological period, and has since ceased, it is *improbable* that man came last of all species. For, as Alfred Russel Wallace pointed out, his bodily evolution waned when intellect became dominant; whereas nothing analogous has interrupted specific differentiation amongst wild animals.

* Unless the *Ratitæ* long antedated the *Carinatæ*. The former may have produced some of the footprints. (Cf. Dr. Henry Woodward, *Proceedings Geologists' Association*, February 1886, pp. 368–69.)

MYTHS OF NIGHT AND WINTER.

By "Stella Occidens."

(*Continued from p. 113.*)

We have considered a few of the most popular myths with regard to night and winter in European countries. Let us now cross over to the Western Continent and observe the myths on this subject which prevail among the North American Indians.

Glooskap, according to the Passamaquoddy Indians, once sailed in his stone canoe far away, no one knew where, but beyond the sea. He will return some day. Some say he went to the west. He lives in a very great, a very long wigwam, and he always makes arrows. One side of the lodge is full of arrows now. When it is all quite full, he will come forth at a new twilight of the gods, exterminate the *Iglesmani*, and establish an eternal happy hunting-ground. Glooskap is deliberately preparing for such a fight, thus resembling the solar warriors in the Norse traditions. Glooskap is now living in a Norse-like Asa-heim; but there is to come a day when all the arrows will be ready, and he will come forth and slay all the wicked. Here, again, Norse mythology is identical with the Indian. A day will come when there will be a great final war and death of heroes, and after all a new world:—

> Then shall another come, yet mightier,
> Although I dare not his name declare.
> Few may see further forth
> Than when Odin meets the wolf.*
> ("Hyndluloid," p. 62.)

This idea of Glooskap returning recalls the expected return of Barbarossa, King Arthur, the Three Tells, and other great heroes who are to return some day. On the occasion of a visit of Henry II. to Wales, the Welsh bards recited a poem relating to King Arthur. It told how the latter set forth his trusty knights—

> On conscious Camlan's crimsoned banks,
> By Modred's faithless guile betrayed,
> Beneath a Saxon spear to bleed!

King Arthur is wounded, and all unseen an elfin queen throws her mantle of ambrosial blue over the hero:—

> And bade her spirits bear him far,
> In Merlin's agate-axled car,
> To her green isles enamelled steep,
> Far in the navel of the deep.

She waved an opiate wand o'er his brow, and to the sound of soft music closed her magic curtains round:—

> There renewed the vital spring,
> Again he reigns a mighty king.

Some day he will return to Britain to resume his ancient sceptre:—

> Once more in old heroic pride
> His barbed courser to bestride:
> His knightly table to restore,
> And brave the tournaments of yore.

As another instance of the expected return of a hero, we have the Swiss legend of William Tell. This skilful archer, who shot the apple off his son's head, is no other than the last reflection of the sun, according to Dr. Dasent. "Constrained for awhile to obey the powers of the tyrants (cold and darkness), he at last escapes, like the skilful oarsman Dagon, traverses the tempestuous sea of night, and leaps at daybreak in freedom on shore. He destroys the oppressor who kept him in bondage. But the sun, like Siegfried, Sigurd, and the Sleeping Beauty, is not invulnerable, and, being betrayed, is bound by the frost giants or slain by the demons of darkness. Thus 'Allfadir,' really no other than Odin, who himself must perish, and whom at the day of doom the wolf, the Fenriswolf, was to swallow at one gulp."† And, again, we have among the Swiss legends the tradition of the Three Tells. "The three founders of the Helvetic confederacy are thought to sleep in a cavern near the Lake of Lucerne. The herdsmen call them the Three Tells, and say they lie there in their antique garb in quiet slumber, and, when Switzerland is in her utmost need, they will awaken and regain the liberties of the land."

Thus we see that the mysterious disappearance of a great

* "Algonquin Legends." Leland, p. 133.

† "Chips from a German Workshop." Max Müller, p. 194, and p. 232.

hero, who is to return at the right moment, and lead his people to victory and happiness, is a popular myth all over the two continents. Among the Iroquois it is Ioskeha, Wasi to the Cherokees, Tamoi to the Caribs, and among the Algonquins it is Michabo.

He is said "to sleep through the winter months, and at the time of the falling leaves, by way of composing himself for his nap, he fills his great pipe and divinely smokes," or, as Dr. Brinton expresses it, "in the autumn, in the moon of the falling leaf, ere he composes himself to his winter's sleep, he fills his great pipe and takes a godlike smoke." The balmy clouds float over hills and woodlands, filling the air with the haze of the "Indian Summer." *

Among the Hiawatha legends is a quaint Odjibwa allegory of Winter and Spring. Schoolcraft relates it as follows:—

An old man was sitting in his lodge by the side of a frozen stream. It was the close of winter, and his fire was almost out. He appeared very old and very desolate. His locks were white with age, and he trembled in every joint. Day after day passed in solitude, and he heard nothing but the sounds of the tempest, sweeping before it the new fallen snow.

One day, as his fire was just dying, a handsome young man, named Seegwun, approached and entered his dwelling. His cheeks were red with the blood of youth, his eyes sparkled with animation, and a smile played upon his lips. He walked with a light, quick step. His forehead was bound with a wreath of sweet grass in place of a warrior's frontlet, and he carried a bunch of flowers in his hand.

"Ah, my son!" said the old man, "I am happy to see you. Come in. Come, tell me of your adventures, and what strange lands you have been to see. Let us pass the night together. I will tell you of my prowess and exploits, and what I can perform. You shall do the same, and we will amuse ourselves."

He then drew from his sack a curiously-wrought antique pipe, and, having filled it with tobacco, handed it to his guest. When this ceremony was over the old man spoke as follows:—

"I blow my breath, and the streams stand still. The water becomes stiff and hard as clear stone."

"I breathe," said the young man, "and flowers spring up all over the plains."

"I shake my locks," said the old man, "and snow covers the land. The leaves fall from the trees at my command, and my breath blows them away. The birds rise from the water and fly to distant lands. The animals hide themselves from my breath, and the very ground becomes as hard as flint."

"I shake my ringlets," said the young man, "and warm showers of soft rain fall upon the earth. The plants lift up their heads out of the earth; my voice recalls the birds; the warmth of my breath unlocks the streams; music fills the groves wherever I walk, and all nature rejoices."

At length the sun began to rise. A gentle warmth came over the place. The tongue of the old man became silent. The streams began to murmur, and the fragrance of flowers scented the air.

Daylight showed Seegwun that he had been entertained by Peboan with the icy visage. Streams began to flow from his eyes. As the sun increased he grew less and less in stature, and soon had melted completely away. Nothing remained on the place of his lodge fire but the miskodeed, a small white flower (*Claytonia virginica*) with a pink border, which is one of the earliest species of northern plants.†

* "Myths of the New World," Brinton, p. 177.

† "Hiawatha Legends," Schoolcraft, p. 99.

In conclusion, we may note the account of how Glooskap found the Summer, which appears to be the more complete form of the legend of Peboan and Seegwun.

"In the long time ago when people lived always in the early red morning, before sunrise, Glooskap went very far north, where all was ice. He came to a wigwam. Therein he found a giant, a great giant, for he was Winter. Glooskap entered; he sat down. Then Winter gave him a pipe; he smoked, and the giant told tales of the old times.

"The charm was on him; it was the frost. The giant talked on and froze, and Glooskap fell asleep. He slept for six months like a toad. Then the charm fled, and he awoke. He went his way home; he went to the south; and at every step it grew warmer, and the flowers began to come up and talk to him.

"He came to where there were many little ones dancing in the forest; their queen was Summer. I am singing the truth; it was Summer, the most beautiful one ever born. He caught her up; he kept her by a crafty trick. The Master cut a moose-hide into a long cord. As he ran away with Summer, he let the end trail behind him.

"The fairies of Light pulled at the cord, but as Glooskap ran the cord ran out, and, though they pulled, he left them far away. So he came to the lodge of Winter—but now he had Summer in his bosom—and Winter welcomed him, for he hoped to freeze him again to sleep. I am singing the song of Summer.

"But this time the Master did the talking. And ere long the sweat ran down Winter's face, and then he melted more, and at last he had melted quite away, as did the wigwam. Then everything awoke: the grass grew, the fairies came out, and the snow ran down the rivers, carrying away the dead leaves. Then Glooskap left Summer with them, and went home."

AMERICA'S GROWTH.*

ERRONEOUS ideas are entertained by most Englishmen and by many Americans about the relations existing between that portion of the great English-speaking community which remains associated with Great Britain, either at home or in her colonies, and that other portion, now the main body, which prefers to have its own system of government apart from the old country. That the diversity between the two systems of government differentiates these two portions of communities not only English-speaking, but to all intents and purposes British, into different nations, must of course be admitted; but that there ought to be any feeling apart from taste or convenience which should cause any member of either of these communities to attach himself preferably to one rather than to the other seems, if we consider the question as it actually stands at present, absurd on the face of it. During a period extending over about a century and a half, Britons (themselves a race of settlers in Great Britain) settled in various parts of North America, without any feeling that they were deserting their own kindred in thus making homes for themselves elsewhere. Gradually as they grew in numbers, as they gathered together into cities, and as their wealth increased, they appeared of greater importance in the eyes of the home government, as being better worth taxing to

* "Triumphant Democracy; or, Fifty Years' March of the Republic." By Andrew Carnegie. London: Sampson Low, Marston, Searle, & Rivington.

supply the sinews of war for contests in Europe. It was not, however, as enemies of Great Britain that they resisted, but in self-defence against the injustice of rulers who regarded nations as a sort of property. They were not Americans fighting against Britons, but Britons in America fighting for independence against the rulers of Great Britain at home. If national rivalry at all were in question, one might say, considering that the king of Great Britain was of almost undiluted German blood, and that besides Britons only Germans fought against the independence of our British race in America, that the contest was between Britons and Germans. This, however, would be to exaggerate the difference between the actual character of the War of Independence and what that war is commonly held to be, alike by Britons here, and by men of our own British stock in America: and no exaggeration is needed. The mistake actually made is marked enough. It prevents the average Briton from glorying in the noble effort by which our people more than a century ago achieved victory for their just cause; and it prevents the average American from recognising that it was while Americans were British in name as well as in fact (for this they have always been) that they achieved the independence which is the greatest glory of one of these nations, and should be the greatest glory of both.

America being derived, as we know she was, from an essentially British stock, and being essentially British in blood and character, the Briton who finds it suit his purpose to join the American community has no reason for regarding himself as debarred from so doing by any claims of the home community upon him. There are, in fact, no such claims now any more than there were in the case of those who went out as colonists to America in the seventeenth and eighteenth centuries. Nor should an American who finds it convenient to make the old country or one of its colonies his home, consider that he is deserting his own people any more than a Virginian or a New Englander would so think, who found it convenient to return to England in the old days, before the War of Independence had definitely separated the British race into communities having different governments. The only kind of patriotism which can be regarded by reasoning men as a virtue, is loyalty to the people; loyalty to a form of government and loyalty to a tract of land are qualities appropriate only to semi-savage races.

If all Britons believed in monarchy, not only as a system which it would be inconvenient to change, but on principle, and if all Americans were equally earnest in the belief that a man is necessarily degraded who remains within a community ruled (even nominally) by a sovereign, the case would doubtless be very different. It would then be a point of patriotism for a Briton to remain British and for an American to remain American. Or if war were likely, one might almost say if war were possible, then—as war, essentially degrading, necessarily brings with it many unpleasant conditions—it might be a sort of duty for Americans and Britons, alike, to remain severally under their own respective flags. But Britons are not monarchist nor Americans republican in that foolish sense. The Briton knows that he has taken nearly all effective evil out of monarchy—for all at least who respect the dignity of their manhood. (As for the rest, those who being free prefer to ape slavery and having the right to stand erect fall to boot-licking—with an appetite—it matters little what form of government *they* have.) The American, in like manner, knows that if he and his fellows willed they could substitute a king for a president, yet give up no atom of their freedom or their self-respect.

The Briton, even if he call himself (not being concerned about trifles) a subject, is as free from all real subjection as the American citizen. If he speaks with esteem or respect of any king or queen who chances, as has happened, to be virtuous and intelligent—or even both—it is as men or women he regards them, and his respect implies no admission that the original atrocities were just by which the English monarchy was founded and the people temporarily brought into real subjection. Still less does such reasonable esteem for a king or queen chancing to be worthy of esteem imply approval of the wars, the iniquities, or the immoralities by which nearly all the rulers of this country afflicted and offended the people in past times. The American in like manner knows that neither his own people nor the kindred people here would suffer such iniquities or anything approaching to them to be perpetuated, even though America should choose to give to its government the title of monarchy, or though Great Britain still allows the name to remain after the evil of it is dead.

As for war, if war is possible between two such communities as Great Britain and America, then the shame of that is such as to overshadow any such shame as might belong to being on one side or the other side in a contest which would be unutterably degrading to both.

These remarks have been suggested by the reading of Mr. Andrew Carnegie's interesting work, "Triumphant Democracy." It brings before the reader more thoroughly than any book we have yet seen the importance of the ethnic question in considering the fortunes of a nation, and the comparative insignificance of the particular form of government which the nation may find convenient. Mr. Carnegie calls his book "Triumphant Democracy," but, so far as we can see, he in no sense shows that democracy, as such, has had much to do with the progress of America. Democracy regarded in its negative aspect has been, doubtless, all-important in determining the fortunes of the States. But this implies only the converse proposition that a nation which begins its career in a state of actual subjection to more or less rapacious rulers, and their plunder-loving followers, cannot possibly make rapid progress until it has shaken itself free and replaced a state of real subjection by one of practical citizenhood. If the progress of America during the last century has been almost incomparably more rapid than that of the old country, it has not been because of any inherent virtue in democracy, but because the progress of America as a nation has not been hampered by oppressive misgovernment. There is curious evidence of this in the degeneracy of the present race of politicians in America. England would be ruined in a couple of generations if her politicians were as worthless as those who have attained power in America (we make no comparison in regard to English statesmen, for there are no statesmen in America).

But what good fortune it is to a nation to be let alone, to have a fair start in national life instead of having to struggle out from under a dead weight of oppression, this book shows well. We commend it to the careful study of those who imagine that they have settled the whole question by pointing to municipal bribery at New York, corrupt State legislation at Albany, and iniquitous political life at Washington. Compare the nation fairly and truly pictured in this book, a nation about as much to be judged by its politicians as England by lords-in-waiting and other flunkeys at court, with the America of a hundred years ago—extending the comparison so that while the former is compared with the England of to-day the latter is compared with the England of a hundred years ago—and it will be felt, we think, that America must have had some immense advantage in the race. What that advantage has been cannot well be doubted. Democratic government has done little for America, and of late the little that her politicians have done has been harmful; but the power and the right which Americans possess to go their own way, and their manful determination to hold that right, let Governments, their own included, do what they will, have been all-in-all to the great nation of our kinsmen across the Atlantic. Even the possession of the suffrage by persons utterly unfit to vote on any higher question than the paving of a back alley has not been able to do one-thousandth part of the harm one might have expected.

The illustrative map, taken from an old edition of the "Encyclopædia Britannica," is as strongly suggestive of what America was when that map was thought sufficient, as is the letterpress of that work so far as it relates to the United States. Not one page in all is devoted to the description of the infant nation which had just begun to run alone. Except for a line or two about Virginia, one might suppose the States were still British colonies, though the edition bears date 1783. Not a single line implies that there had been any contest worth mentioning on the other side of the Atlantic. The map was manifestly drawn to correspond with this feeling of contemptuous indifference for the young nation.

America was, indeed, but a small nation then, though it deserved the respect and sympathy of Great Britain, since, while as yet it was not America but a community of British colonists, it had maintained its just claims to independence against the full strength of the mother country. But consider what it is now! The three millions of 1770 had grown to thirteen millions in 1830, and now to nearly sixty millions—"more English-speaking people than exist in all the world besides," more than the whole population of the United Kingdom *plus* twice the population of the British colonies. In 1850 the total wealth of the United States was 1,686,000,000*l.*, that of Great Britain being 4,500,000,000*l.*; now the wealth of Great Britain is about 9,000,000,000*l.*, or almost exactly double what it was in 1850; but the wealth of the United States had risen in 1880 to 9,790,000,000*l.*, and is now nearly 11,000,000,000*l.* In 1850 it was hardly worth while to mention America's manufactures in the same breath with those of Great Britain; in 1880 British manufactures amounted to 818,000,000*l.*, those of the States to 1,112,000,000*l.*, nearly half as much as the manufacturing wealth of the whole of Europe. As our author well puts it, though Great Britain manufactures for the whole world, while America is gaining only the control of her own markets, British manufactures in 1880 had not two-thirds the value of those of the century-old republic. The annual savings of America are 210,000,000*l.*, exceeding those of the United Kingdom by 50,000,000*l.* and those of France by 70,000,000*l.* In comparing the American carrying business with that of Great Britain, we seem to find the younger country behind, since the American shipping amounts to but nine millions of tons, that of Great Britain to eighteen millions. But when we consider the internal commerce between the States we recognise a difference the other way. This internal commerce exceeds the entire foreign commerce of Great Britain and Ireland, France, Germany, Russia, Holland, Austro-Hungary, and Belgium combined. The Pennsylvania Railroad system, alone, transports more tonnage than all our British merchant ships!

These are but a few samples of the wonders which Mr. Carnegie—a Scotsman by birth, and not a politician, but a man of business—has to tell about the development of America. We commend his book to the careful reading of men who think: for party men, or men otherwise liable to be swayed by mere prejudice, the work will be pleasing or irritating, according to the direction in which their proclivities tend. But for those who look hopefully, or at least longingly, to the future of the human race, it is a work whose every page will be full of meaning.

EVOLUTION OF LANGUAGE.

By Ada S. Ballin.

VII.—THE ORIGIN OF ROOTS.

When discussing the origin of the natural sign language* I showed how its words are formed by the reproduction of the natural signs of emotion, by the imitation of the characteristic aspects, movements, or uses of objects, and for brevity by the representation of marks characteristic of certain objects. Similarly words may originate by imitation of:—

1. Natural sounds, which are the outward expression of sensations or emotions.

2. The sounds produced by animals, which are, as it were, marks each characteristic of the animal that utters it.

3. The sounds produced by the movement of inanimate things, and in the use of objects by man.

In considering the first class we find that certain sounds, which are called interjectional, are common to races speaking widely different languages, and they are so because they are the natural and instinctive expression of feelings which are common to all mankind. Such are sighs and groans, as Ah! Oh! which, pronounced in various tones, express very different feelings, as, for example, all shades of grief, pain, surprise, admiration, and even pleasure. The words *woe*, Saxon *wa*, Latin *væ*, Greek *ovai*, Welsh *gwae*, German *Weh*, Dutch *wee*, Swedish *ve*, Hebrew *hoi*, are imitative of the sounds of sighing which we find in the emotional interjections: *heigho*, Wolof language of Africa *hhihhi*, Hebrew *Ahăh*, *hăh*, and *hó*. Another set of derivatives from the same source may be seen in our *hi!* stop! *way! whoa!* when addressed to horses; Challam Indian *hói!*—which may all be taken as meaning "There's danger ahead, so stop," or "It will be worse for you if you don't stop."

In Chinese plays of the Yuên dynasty *ŭ* and *wŭ* are used as exclamations or calls to inferiors, as *ŭ-nâ fŭ-jîn pŭ-yaŭ tí-k'ŭ*, "O woman! do not cry and weep"; *wŭ-ui kí-shŭ-tî!* Halloa! Postman!" In the Shi-King *hŭ-hŭ!* an exclamation arising from pain, is used as "Oh! Alas!" The Hebrew *hoi* or *oi* is used, 1, of lamentation; as *alas!* 2, of threatening, as: "*Woe* to the sinful nation," Isaiah i. 4, like *ho! woe! hei!* Greek *oi*, Latin, *væ!* and also, 3, of admonition, like *ho! heus! he! Hoi erets*, &c. (Isaiah xviii. 1), translated, "Ah, the land, &c." *Hó*, in Chinese, is used as a noun, "Misery."

* Knowledge, vol. vii., p. 516.

A curious instance of the introduction into language of a sound produced by an emotional expression is that of the sound *o*. In Japanese *o* is used as a prefix of honour, as: *mets'ké*, a spy (literally eye-fixer). *O mets'ké*, a princely or imperial spy, *Oo mets'ké* the spy in chief. *Oo* also, by a natural transition, becomes the interjectional adjective "great." The Iroquois of North America form compound words with the sounds *io*, indicative of admiration; in Mohawk, *Garonta* means a tree; *Garontio*, a beautiful tree; and *Ohio*, means a beautiful river. The similar usage of the sound, among such widely different peoples, may be accounted for by the fact that when anyone is startled or astonished the mouth is widely opened to draw a deep breath, and so be ready for action. When the next expiration takes place the mouth is slightly closed, and the lips protruded, so that the sound of a long *o* is produced. I remember that, when I was a child, if fireworks were being displayed, at each discharge a sort of deep groaning, "Oh!" invariably came from the crowd; but now that fireworks are so frequently seen, that sound is rarely heard, or, if at all, only from one or two voices, instead of being, as formerly, unanimous.

Darwin observed that when on a quiet night some rockets were fired from on board the *Beagle*, which was anchored in a little creek at Tahiti, as each rocket was let off there was absolute silence, invariably followed by a deep groaning *Oh*, resounding all round the bay. When pain is felt with surprise, the tendency to contract all the muscles of the body which accompanies pain causes the lips to be drawn back, and the sound, becoming higher, assumes the character of *Ah!* or *Ach!* The Chinese interjection to indicate pain is *ai-ai* (cf. Italian, *ahi*, in *ahimè*, woe 's me). Mr. W. Mathews says the North American Indians express astonishment by a groan, which doubtless resembles the sound described by Darwin. The deaf, dumb, and blind Laura Bridgeman, to whom I have previously referred, when amazed, rounds and protrudes her lips, opens them and breathes strongly, making a sort of sound, *ho-o-f-f*, for wonder. Indeed, the lips are often protruded in astonishment, and the same expression has been observed in the chimpanzee and orang. Mr. Winwood Read states that the negroes of the west coast of Africa under the same emotion protrude their lips and make a sound like *heigh-heigh*. Among the Chinese *ai-ya* (cf. Latin *eja*) is an expression of joy and surprise.

If the mouth is not much opened whilst the lips are considerably protruded, the result is a blowing, hissing, or whistling sound, and Mr. R. Brough Smyth informed Darwin that an Australian from the interior on being shown an acrobat turning head over heels "was greatly astonished, and protruded his lips, making a noise with his mouth, as if blowing out a match." Mr. Bulmer says the Australians make an exclamation of surprise *korki*, "and to do this the mouth is drawn out as if going to whistle." Europeans whistle when surprised, Englishmen utter an exclamation written *whew*, and Mr. Mansel Weal saw a Kaffir girl who, on hearing of the high price of an article, "raised her eyebrows and whistled just as a European would."* *Yâ* and *ā* in Chinese denote wonder and astonishment, while *hî* is an exclamation of admiration used in poetry, as: *pí meí jîn hî!* that beautiful person!

When an unpleasant odour is encountered, an instinctive action takes place by which the nostrils are closed, the lips narrowed almost to closure, and a rapid expiration made, in order to get rid of the noxious particles. In so doing the sound of *f* is produced; the same gesture is frequently made when the feeling of disgust or displeasure is mental. Thus Laura Bridgeman when displeased would make the sound *f*, *ff*, or *fi*. The same sound may be found in our

* See Darwin's "Expression of the Emotions," p. 285 *et seq.*

expression, "Fie! for shame," or in the exclamation commonly written *faugh!* A more explosive action in blowing through the mouth as if to get rid of an offending object will produce the sound *pooh*, *pish*, or *pshaw*, often written as exclamations, and to this origin may be traced a number of words in many different languages. Such, for example, is the Sanskrit *pûy*, to become *foul* (whence Latin *putridus*, our *putrid*), *piy* and *pîy*, to revile, hate. The Zulu says of turned-off meat, "the meat says *pu*" (stinks). In Timorese *poöp* means putrid; Quiché *puh*, *poh* signifies corruption—our *pus*: *pohir* is to turn bad, *puz* rottenness; Hebrew *puahh*, to exhale as odours, blow (cf. Malay *puput*, to blow), utter, pant, rail against (cf. Maori *puku*, to pant). From the same source comes also the verb to *puff*, with all its derivatives, even to powder-*puff*. From the idea of a *puff* of smoke comes the Australian *pooyu*, smoke; Quichua *puhucuni*, to light a fire; *puhuya*, a cloud; Zulu *fu*, cloud. In Zulu also the word for thorax is *fuba*. *pupuma* means to bubble, boil, and very many other derivatives from the same instinct-sound, if I may so call it, might be cited. The English *spue* and *spit* have similar origins, and the sound of forcible ejection from the mouth is heard in Tahitian *Tutua*, to spit. In Chinese *p'ï* is used to express contempt and defiance, and is very often equivalent to "begone!"

Our word *chuckle* is imitative of the sound uttered as an expression of inward amusement and glee, an instinctive sound, as proved by its being made by Laura Bridgeman. The Zulu *gigiteka* is used in the same way as our *giggle*; *hee-hee* or *ha-ha* becomes a word meaning to laugh; Sanskrit, *hahh*. The Chinese make a word *hi-hi* expressive of laughter, and *hi* is used in the sense of "to be glad." Zulu *halala*, to utter a sound of exultation, corresponds to the Hebrew *halal*, to shout, give praise, introduced into English in the form Hallelujah! which means literally "Praise Jah," or Jehovah, and to our *hurrah*.

Interjections may become words: thus from *o*, the answer to a call or cry used by the Gallas to drive cattle, two verbs have been formed—*oardu*, to answer, and *ofa* to drive.

The function of breathing is that which, all over the world, has been and is considered the most significant of life. To say a person has ceased to breathe is equivalent to saying that he is dead. The Hebrew root *hhayah*, to live, is imitative of breathing, and from it come many derivatives. Another form of it is *hhivvah*, to breathe out, declare, show; from it come also *hhavvah*, life, the name of the first woman, Eve; the more-used plural form *hhayim*, life; and *hhayah*, living thing. Another very important form of the verb to breathe is *hayah* to exist, to be, to become, happen; also seen in *havah*, which takes on, moreover, from the idea of breathing after, the meaning to desire, long for; *havvah*, desire, cupidity, or *avah* (with *cav*), to long for, *avvah*, desire, lust—in a spiritual sense, pleasure, will. Closely connected with the latter is the verb *abah*. Compare Latin *aveo*, to be willing, to wish, desire, long for, and the much-used Semitic root *ahab*, to desire, love.

The Sanscrit root *bhu* to be, must also have originated in the imitation of the sounds of breathing; its form closely resembles the above Hebrew words, and from it are derived the Latin *fu* "to be," existing only in the perfect tenses—Welsh *bod*; German *bin*, *bist*, &c.; side by side with *sein*, *ist*, &c.; Saxon *beon*, our English to *be*. To *have* and to *happen* are probably derived from the same origin in the imitation of breathing sounds; the Welsh *hapiaw* is to happen, to befall, to have luck; *hàp* or *hap*, luck, chance, that which falls or comes suddenly, allied with Dutch *happen*; Welsh *hafiaw*, to snatch; Norman *happer*, to seize; French *happer*, to snap or catch (a sound which may be heard when a dog catches in its mouth anything thrown to it). In Spanish *haber* means to *have*, to *happen*, to befall, to take, to possess; thus uniting the meanings of the Latin *cap*, and *hab*, which are apparently cognate words. To our *have* correspond Saxon *habban*, Gothic *haban*, German *haben*, Dutch *hebben*, Swedish *hafva*, Danish *haver*, Portuguese *haver*, Italian *avere*, French *avoir*; and, as mentioned above, Welsh *hafiaw*, to snatch or seize hastily, as well as *hapiaw* to *happen*. Closely allied with this is our slang term *cop*, "to take," with its derivative *copper*, "a policeman."

The Hebrew word *ruahh*, meaning air in motion, wind, and which to my ear is distinctly imitative, applied also to breath of the nostrils, *snuffing*, snorting of *anger*, like *aph* from *anaph* to breathe, comes to be used in the same way as the Latin *spiritus* (literally breathing), as spirit, soul, vital principle; and *néphêsh*, breath, from the root *naphash* is similarly used. *Anaph* (whence *aph*, anger), to breathe, especially through the nostrils, is used in the sense of to be angry, and is imitative of the hard breathing of anger. The root *ruahh*, to breathe, is cognate with *puahh* to blow, and *nuahh* to respire, breathe quietly, hence to rest. It is used in the same way as in the Germanic languages the root *huch*, *hugh*, Allemanic *hughi*, Swedish *hugh* = Hebrew *ruahh*, spirit. The Hiphil form of the verb *ruahh* is *hêriahh*, to smell, similar to the German *riechen*, in smelling, the air being drawn in and expired through the nostrils. Followed by a particle meaning *in*, it comes to mean smelling with pleasure, to delight in (Isaiah xi. 3, "His delight shall be in," &c.). *Réahh nichoahh*, "a sweet savour," also means something pleasant in a moral sense. Another derivative of the word *ruahh* is *ravahh*, to be spacious, ample, loose; hence, *révahh*, space (Genesis xxxii. 17), relaxation, freedom from distress (Esther iv. 14). Imitative of the sound of hard breathing, we find *shaaph*, to pant, catch at with open mouth; hence, by an easy transition, to hasten. Cognate to this root are *shuph*, to gape upon—hence, lie in wait for; *nashaph*, to blow—whence *nésheph*, evening twilight, when the cool breeze blows, and, further, darkness, night (Isaiah v. 11), or morning, when there is also a cool breeze (Job vii. 4), *nashaph* being only another form of the more largely used root *naphash*, for, as we have seen, the transposition of sounds is a very common linguistic change. These roots may be compared with the German *schnauben*, to breathe heavily, pant for; *schnaufen*, to puff and blow; and *schnappen*, to *snap*, gasp, catch at. We find the same idea in *puahh*, to breathe, blow, blow out; also to utter and rail against, in which sense it is connected with the word *pêh*. Arabic *fu*, mouth. In Hebrew the sounds *p* and *f* are interchangeable and represented by the same letter of the alphabet; for example, *pêh* with the prefix *l*, meaning "to," becomes *lephi*, "according to." *Puahh* is also closely connected with the word *naphahh*, to blow, breathe, kindle (as a fire); cf. German *fachen* and *anfachen*, and *yaphach*, used in the Hithpael form (Jeremiah iv. 31), to pant or sigh deeply.

OUR PUZZLES.

THE Puzzles for last month in their simplest form are dealt with in what follows:—

PUZZLE XXV. *To build up four tetrahedrons and six square-based pyramids having equal triangular faces into a square-based pyramid.*

Set four of the pyramids so that their square bases AEKH, EBFK, KFCG, and KGDH, fill the square ABCD as shown in fig. 1, their vertices being at L, M, N, and O.

Into the space EMKL fit a tetrahedron of which EK and LM are opposite edges, and in like manner fill in the spaces KMFN, KNGO, and KOHL. Into the space LMNO fit a pyramid

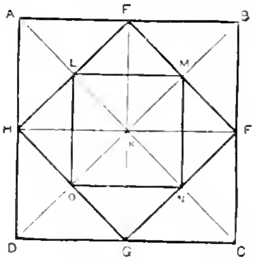


FIG. 1.

apex downwards, and on its base LMNO add another pyramid. We thus get the pyramid ABCD having equilateral triangular faces AKB, BKC, CKD, and DKA.

Cor. 1. It is obvious that we can in like manner set nine pyramids to fit a square base; and fit in between them 12 tetrahedrons; and then fit in 4 pyramids apex downwards, whose 4 bases will give a surface such as ABCD, fig. 1. On this we build up as before a pyramid in which are 6 pyramids and 4 tetrahedrons. We thus build up 19 pyramids and 16 tetrahedrons into a pyramid on a square base and with equilateral triangular faces.

Cor. 2. So can we build up 16 pyramids apex upwards +9 apex downwards +9 apex upwards +4 apex downwards +4 apex upwards +1 apex downwards +1 apex upwards, into a square-based equilateral-faced pyramid, by fitting in 24 tetrahedrons in lowest layer, 12 in the 2nd, and 4 in the 3rd—making 44 pyramids and 40 tetrahedrons in all.

Cor. 3. And manifestly, if a square base has a side containing an edge of a pyramid or tetrahedron, n times the number of pyramids and tetrahedrons required to build up a pyramid on that base will be as follows :—

$$\text{No. of pyramids} = n^2+2\left[(n-1)^2+(n-2)^2+\ .\ .\ .\ +9+4+1\right]$$

$$= n^2+\frac{n-1}{3}(2n-1)n$$

$$= \frac{n}{3}(2n^2+1)$$

(Observe that if n is not divisible by 3, $2n^2+1$ is necessarily divisible by 3; for in that case n is of one of the forms $3r\pm1$, and $\therefore 2n^2+1$ is of one of the forms $18r^2\pm12r+3$.)

$$\text{No. of tetrahedrons} = 4\left[(1+2+3\ .\ .\ .\ +n)+(1+2+3+\ .\ .\ .\ +n-1)+\ .\ .\ .\ +6+3+1)\right]$$

$$= 4\left[(1+2+3+\ .\ .\ .\ +\overline{n-1})+(1+2+3+\ .\ .\ .\ +n-2)+\ .\ .\ .\ +10+6+3+1\right]$$

$$= \frac{2}{3}(n-1)n(n+1)$$

$$= \frac{2n}{3}(n^2-1)$$

(Obviously if n is not divisible by 3, n^2-1 must be divisible by 3, its two factors being $n+1$ and $n-1$, one of which must be a multiple of 3 when n is of one of the forms $3r\pm1$.)

When n is very large, we see that the numbers of the tetrahedrons and pyramids approach a ratio of equality. The number of pyramids, however, always exceeds the number of tetrahedrons by n. Thus, if $n=1{,}000$, or there are a million pyramids in the base layer, the entire pyramid, which will require $\frac{2000}{3}$ (999,999), or 666,666,000 tetrahedrons, will require $\frac{1000}{3}$ (2,000,001), or 666,667,000 pyramids—*i.e.*, 1,000 more pyramids than tetrahedrons.

PUZZLE XXVI. *To build up six octahedrons and eight tetrahedrons having equal square faces, into a single octahedron.*

It is obvious that if AEKH, EBFK, KFCG, and KGDH, fig. 1, represent octahedrons projecting below as well as above the plane ABCD, a fifth octahedron LMNO, with four tetrahedrons in the previous case, will complete the semi-octahedron ABCDK *above* the plane ABCD, while a sixth octahedron and four tetrahedrons *below* this plane, will complete the other semi-octahedron, or build up the entire octahedron.

Cor. 1. Clearly we can build up 9 octahedrons+4 octahedrons above +4 below the first nine=1 octahedron above +1 below, with 12 tetrahedrons above +12 below the nine octahedrons +4 above +4 below, to make a single octahedron, using in all 19 octahedrons and 32 tetrahedrons.

Cor. 2. Similarly can we build up a single octahedron of 44 octahedrons and 80 tetrahedrons, simply dealing with the case as in Cor. 2 on the previous puzzle, but using as many tetrahedrons below as above the square base of the upper semi-octahedron, and octahedrons instead of semi-octahedral pyramids throughout.

Cor. 3. And manifestly, if the edge of the containing octahedrons is n times as long as any of the equal edges of the component octahedrons and tetrahedrons, the numbers of these solid figures will be as follows :—

$$\text{No. of tetrahedrons} = \frac{n}{3}(2n^2+1).$$

$$\text{No. of octahedrons} = \frac{4n}{3}(n^2-1).$$

the number of octahedrons being always less than twice the number of tetrahedrons by $2n$ (or the number of octahedrons always n greater than half the number of tetrahedrons). But when n is very great, the number of tetrahedrons becomes very nearly twice as great as the number of octahedrons.

NOTE. I propose to leave till next month the inquiry into the way in which, when space is filled in with octahedrons and tetrahedrons, or with semi-octahedral pyramids and tetrahedrons, the component solids can be shifted in slices or in strips. One of the puzzles given this month will be found to bear on these points.

PUZZLE XXVII. *To find a semi-regular solid of such a form that any number of such solids, of equal size, can be built up into a single solid without interstices; as a solid may be built up of equal cubes, but within the solid thus built up no shifting or sliding must be possible (as in the case of a cube-built solid) without interruption of continuity.*

I propose to leave the discussion and demonstration of this puzzle to next month, giving for the present only the solution :—

The solid required is a semi-regular dodecahedron. It has twelve faces, each a rhombus or diamond, so that all its

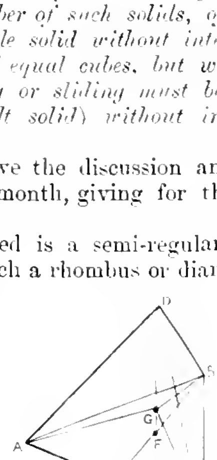


FIG. 2.

edges are equal. The solid angles of the figure are made up of three of the larger, or four of the smaller angles of the diamond faces. The figure of the rhombus may be defined as having its larger angle equal to that subtended by an edge of a regular tetrahedron from the tetrahedron's centre of figure. Thus, let ABCD, fig. 2, be a regular tetrahedron; BE perpendicular to and bisecting AC; DF perpendicular to BE (EF one-third of BE); FG one-fourth of DF (so that G is the centre of gravity, and of figure, of the tetrahedron ABCD. Join AG, GB, BC. Then AGC, BGC, BGA, are severally

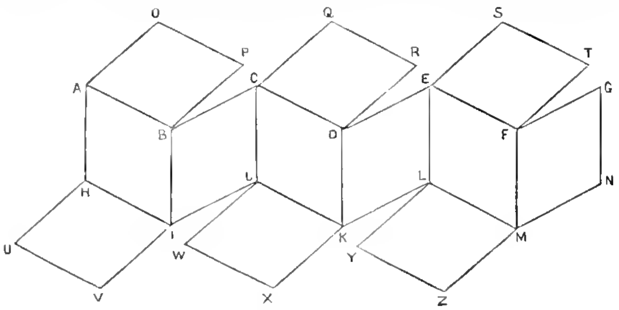


FIG. 3.

halves of the rhombus required; and AGBC is one of the three-planed solid angles of the solid required. It is easy to obtain DG by a geometrical construction; or arithmetically thus, putting the edge of the tetrahedron equal to $2a$:—

$$\text{DG} = \tfrac{3}{4}\text{DF} = \tfrac{3}{4}\sqrt{\text{DB}^2 - \text{BF}^2};$$

$$\text{also } \text{DB}^2 = 4a^2;\ \text{BF}^2 = \tfrac{4}{9}\text{BE}^2 = \tfrac{4}{3}a^2;$$

$$\text{wherefore DG} = \tfrac{3}{4}\sqrt{\tfrac{8}{3}a^2} = a\sqrt{\tfrac{3}{2}} \text{ or } \tfrac{a}{2}\sqrt{6} = 1{\cdot}225a \text{ nearly} = \frac{49a}{40} \text{ nearly.}$$

Thus DG = AG = BG = CG = AW forty-nine eightieths of AC, AB, BC, or BD.

The diamond faces for our solid can be readily constituted from this known proportion. They have the shape and form in the twelve diamonds of fig. 3, which represents what is

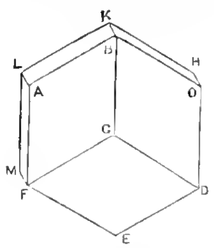


FIG. 4.

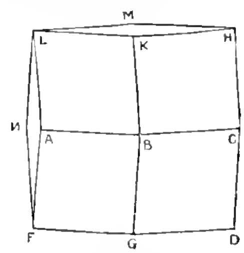


FIG. 5.

called the "net" for the required solid. The student will find it interesting to cut out such a "net" in card, dividing half through the card along AB, BI, HI, &c., and then bending the card into the form of the solid shown, in two aspects, in figs. 4 and 5.

MATHEMATICAL RECREATIONS.

OUR PUZZLES.

FOR this month I suggest three puzzles connected with the last three, and also with those which preceded them in March, February, and even January (when the orange-packing puzzles appeared). Any one who studies out the geometrical and arithmetical relations involved in these puzzles will find that he has gone through instructive exercises.

PUZZLE XXVIII. *Show how to build up a regular tetrahedron of smaller tetrahedrons and octahedrons having equal triangular faces and edges commensurable in length with those of the built up tetrahedron. (Simplest form of the problem is to build four tetrahedrons and one octahedron into a tetrahedron.)*

PUZZLE XXIX. *A number of equal spherical shells, of highly elastic skin-like material, are filled with a gas which expands energetically when its temperature is raised. They are piled up in pyramids like cannon-balls, and the pyramids enclosed in rigid casings; or they are packed in boxes like the oranges in the January puzzles, remaining all globular and equal. Being then exposed to a constantly increasing temperature, the shells expand, losing their globular form, and eventually becoming everywhere flat-faced. Determine the shapes the shells assume in the middle of the heap, where the pressures around each may be assumed to be uniform. (Near the enclosing casings, of course, the pressures are not uniform.)*

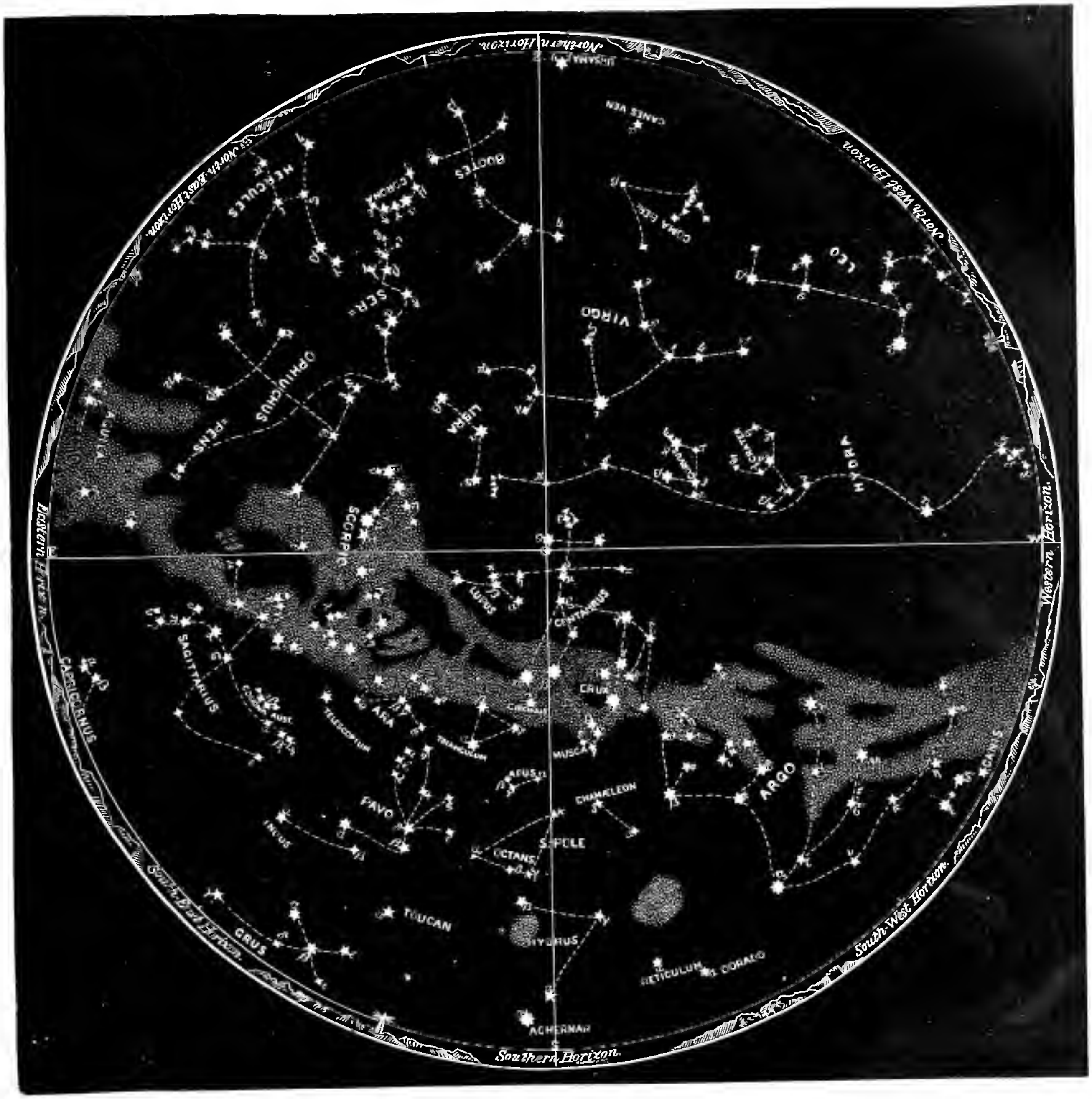
PUZZLE XXX. *Six Alpine tourists, three of them men, are nearing the place where they propose to take their midday meal, when one of the ladies asks what they are to do for seats. One of the men, of the kind defined by Dickens as "an ingenious beast," propounds to the other two a plan by which the six alpenstocks of the party can be converted, in a few minutes, into a comfortable and symmetrical structure on which the whole company may be seated. The party have with them plenty of rope (being prudent mountaineers) and a good supply of stout cord. Within less than ten minutes after the arrival of the tourists at their resting-place all six are comfortably seated. What was the ingenious beast's plan? (The alpenstocks are each six feet long.)*

NOTE.—For reasons not belonging to the domain of mathematics, the three masculine tourists considered it especially desirable that the party should be seated in pairs, each pair in some degree apart from the others. The ingenious one secured this result also.

RACE CHARACTERISTICS OF THE JEWS.—Dr. A. Neubauer read a paper recently, before the British Anthropological Institute, on "Race Types of the Jews," the purport of which was to show that there had been considerable intermixtures in the Hebrew race from the time of Abraham down. Joseph married an Egyptian and Moses a Midianite; David was descended from a Moabitess, and Solomon was the son of a Hittite woman. So we read of the non-Jewish women in contact with the Israelites, and undoubtedly the proselytes increased the mixture of races by marrying Jewish women. Moreover, some quite marked differences prevailed in the Middle Ages, and still exist, between the Jews residing in different nations. Mr. J. Jacobs, in a paper "On the Racial Characteristics of Modern Jews," took a different view. Regarding only the Askenasian Jews, who form more than nine-tenths of the whole number, he pointed out as among their characteristics fertility, short stature as compared with Europeans, and narrow chests, brachycephalic skulls, darker hair and eyes than those of any nation in Northern Europe (though nearly one-fifth of the Jews have blue eyes, and they have nearly twice as many red-haired individuals as the inhabitants of the Continent), and a peculiar cast of countenance. He pointed out that the purity of the race depended on the number of proselytes made by the Jews in ancient and Mediæval times. The earlier proselytes, before the foundation of Christianity, were mostly fellow-Semites, and would not affect the type, while the numbers made afterward were too small to modify the race. A considerable number of Jews, the Cohens, were not allowed to marry proselytes, and must consequently be tolerably pure. Mr. Jacobs's general conclusion was therefore in favour of the purity of the Jewish race.

THE SOUTHERN SKIES.

MAP VI.—For March, April, and May



The Night Skies in the Southern Hemisphere (Lat. 46° to 24° S.)

and the

Southern Skies in England (Upper Half of Map only) at the following Times:

At 1 o'clock, morning,	April 7.	At 11.30 o'clock, night,	April 30.	At 10 o'clock, night,	May 22.	At 8.30 o'clock, night,	June 14.
,, 12.30 ,, ,,	April 14.	,, 11 ,, ,,	May 7.	,, 9.30 ,, ,,	May 30.	,, 8 ,, ,,	June 22.
,, Midnight,	April 22.	,, 10.30 ,, ,,	May 15.	,, 9 ,, ,,	June 7.	,, 7.30 ,, ,,	June 30.

SOUTHERN SKIES FOR JANUARY.—A Correction.

The dates for the January map, p. 63, were wrongly given, corresponding to the maps of my "Constellation Seasons" (now out of print) not, as they should, to those which form my "Stars in their Seasons." The proper dates and hours for the January map are as follows:—

At 1 o'clock, morning,	Jan. 7.	At 11.30 o'clock, night,	Jan. 29.	At 10 o'clock, night,	Feb. 21.	At 8.30 o'clock, night,	March 16.
,, 12.30 ,, ,,	Jan. 14	,, 11 ,, ,,	Feb. 6.	,, 9.30 ,, ,,	March 1.	,, 8 ,, ,,	March 23
,, Midnight,	Jan. 22.	,, 10.30 ,, ,,	Feb. 14.	,, 9 ,, ,,	March 8.	,, 7.30 ,, ,,	March 30.

THE ONE-SCALE ATLAS.

We give another map of this series, reserving an account of the method in which the sphere has been divided, and each map projected, till our space is less crowded.

THE NEW COMETS.*

By Richard A. Proctor.

ALREADY the year 1887 has three comets on its record, one of which promises to be conspicuous. Small comets, indeed, are found to be so common that we must expect soon to hear of cheaper rates than are at present proffered, somewhat to the lowering of cometic dignity, for their discovery. When prizes were first offered for comet-finding, the value of the prize ran, unless I mistake, to 100*l*. Now, ten or twenty comets may be discovered for less money, and what was thought fair work for a year is now accomplished in less than a month.

The discovery that comets of the smaller type are so numerous is, however, important in itself, though none of the small comets recently discovered have presented any features of interest. Whatever theory is eventually accepted respecting comets must give an account of their great numbers, and it will be found that this is a criterion of no slight significance. Combined with what has already been discovered regarding comets and meteors (the kinsfolk of comets), this discovery goes far in my opinion to indicate the true origin and meaning of these interesting bodies.

The trouble about comets and meteors of late has been that the students of astronomy seem unable to keep count at one and the same time of all the known facts. They insist on starting theories which will account excellently for this or that fact, but are manifestly inconsistent with other facts as well established.

Thus Schiaparelli, noting that some comets have orbits passing near the orbits of one or other of the giant planets, suggests that the giant planets have from time to time captured comets or meteor systems which, before that last unfortunate visit of theirs to our solar system when Jupiter or Saturn or Uranus or Neptune captured them, had been wandering about unattached to any system through interstellar space. The theory leaves far the larger number of comets and meteor systems unaccounted for, it gives no real account even of the origin of those which exhibit the peculiarity it strives to explain, and, as a matter of fact, the giant planets have been proved to be quite incapable of playing the part assigned to them. But for these defects the theory would perhaps be acceptable enough.

Again, Prof. Newton, of Yale, noting that meteor streams travel in the tracks of comets, advances the theory that meteors have been, as it were, chipped off from comets. But as meteors present peculiarities of structure by no means explained by this theory, as a comet must exist before meteors can be chipped from it, and as the chipping process is mechanically impossible, this theory also is open to some slight objections.

Then again, Tschermak, noting the resemblance of structure between meteorites and volcanic products suggests that meteors of all orders (which would include meteor streams, and therefore comets) were shot out from the earth in days when she was young. But though this is better than the other theories, in at least suggesting some sort of an origin for comets and meteors, it will not account for comets which never come within many millions of miles of the earth's orbit, and a theory which fails for some among the comets cannot be the true general theory for meteors either.

Mr. Sorby, of Sheffield, the eminent mineralogist, deduced from the microscopic structure of certain meteorites the startling theory that they had once been inside the sun; for there is evidence that their substance once existed in the form of globules of molten metal, which aggregated into large masses, which in turn were exposed to violent friction, indicating conflicting motions at very high velocities. "Where else," wrote Sorby, in 1864, "could such conditions exist, except first in the interior, and afterwards in the immediate neighbourhood of our sun?" But it is absolutely certain that the theory as thus suggested cannot possibly be true, either as a general explanation of meteors and comets, or even as an explanation of any known meteor system or comet, unless, perhaps, a few of the comets whose orbits pass very near the sun were sunborn, and subsequently disturbed by planetary attractions so as not to return to their parent orb. A flight of meteors, shot out from the sun, as Sorby suggested, might have velocity enough to get away from him for ever, in which case we should never see a trace of it again, not though we waited for millions of years. If, however, it could not get away, then it must return to its starting-place—that is, back to the sun's globe—unless, passing near enough to one of the giant planets, it were so far disturbed as only to return grazing by past the sun's surface. (The comets of 1843, 1880, and 1882, which all had the same orbits near the sun, almost grazing his surface, may well have been parts of a single meteor-flight shot out from his interior millions of years ago.)* As a general theory, this fails like the others.

Better, though still failing as a general theory, is that suggested by Graham, of London, to account for the large quantities of hydrogen "occluded" within the substance of certain iron meteors, and by Daubrée, the French physicist, to account for the volcanic structure of meteorites. According to their theory, meteors, and therefore comets, were shot forth from the interior of stars. As Graham put it, "the iron meteors have brought to us, across the interstellar depths, the hydrogen of the fixed stars." And Daubrée, by arranging meteorites into their several orders, and showing how volcanic products may be similarly arranged in a series including all the forms found in meteorites, extended the theory of stellar origin to include all orders of meteors. Yet are there fatal objections against this, at any rate, as a general theory. It leaves unexplained the peculiarity which Schiaparelli had tried to interpret—the strange tendency among certain comets to hang about the orbits of the giant planets. Moreover, now that the meteor streams crossing our earth's track are numbered by hundreds, a theory which explained all meteors as sprung from the stars would indicate an inconceivably immense number of meteor streams within our solar system to account for our earth's track crossing so many.

To get at the true general theory of comets and meteors we must combine what is sound in all these theories, since the true theory must accord with all the known facts. This is what the theory I have maintained during the past few years actually does, and that is why, so far from admitting that it is a daring theory, I regard the others as overbold (running "à travers" known facts, as they all do) and mine as cautious and modest, startling though its fundamental idea may seem.

All comets and meteors, according to my theory, are sunborn. But it is not to our own sun, with Sorby, nor to those other suns, the stars, with Graham and Daubrée, that I attribute all comets and meteor systems. Many millions have come doubtless from our sun during the many millions of years he has been a sun, though few of his cometic children are known to terrestrial astronomers. Millions of

* Reprinted from the *New York World*.

* Since this appeared it has been announced that the new comet discovered in the Southern skies is also following in the same track—confirming my theory that the comets of 1668, 1843, 1880, and 1882, were parts of one large comet, dissipated, doubtless, millions of years ago.

millions have come from the many millions of suns in our galaxy during the many millions of years of their sunlike existence. But the giant planets were once suns, and in their sunlike state, which must have lasted millions of years, they must have ejected their smaller comets and meteor systems, which even now after millions of years have paths passing near the orbits of their parent orbs. Our earth and her fellow terrestrial planets had their sunlike stage of life, too, and it must have been while the earth was a sun that the meteors explained specially by Tschermak's theory were expelled.

All the known facts correspond with the general theory thus presented ; nor can any fact be noted which even introduces a difficulty, though of course it is very easy, as some astronomers in America have recently shown, to point out that comets and meteors whose interpretation belongs to one part of my theory cannot be well explained if we try to interpret them by another part.

Lastly the only sunlike body we can study, our own sun, has been caught in the very work of ejection which this theory assigns to sunlike bodies.

THE ORIGIN OF MOUNTAINS.*

THE "delightful uncertainty of science" forms one of its chief charms to the candid mind, as the absolute fixity of dogma forms its main recommendation to stupidly conservative and unprogressive intellects. Dull people like to be told a thing once for all, and to stick to it thenceforth and for ever with a Chinese invariability, an immovable stolidity as of the Medes and Persians. Intelligent people modify their opinions in accordance with new facts or new aspects of events as soon as these are brought to their notice. Geology (on its dynamic side at least) is still to a great extent in that plastic stage where great modifications may yet be expected, and where a corresponding modifiability of opinion is therefore most necessary to every student. Mr. Mellard Reade's book on the origin of mountains is a splendid example of the sort of shaking our preconceived ideas may any day suffer. We do not say he has entirely upset all our current notions about the growth of mountain ranges ; we must wait to assert that till his theory has been thoroughly sifted and debated and fought over, as it will be, by all the competent specialists in his chosen science. But we do say he has administered a rousing dose of vigorous scepticism, and submitted the accepted theory on the subject to a powerful solvent, which leaves us at least in an attitude of suspended judgment, with a distinct inclination towards Mr. Reade's own way of thinking.

The theory of the origin of mountain chains at present in vogue—the theory more or less supported, hypothetically at least, by the great names of Lyell and Geikie—refers them in the last resort to tangential strains, regarding them essentially as ridges due to the compression induced in the rigid outer crust of the globe by a shrinkage of the heated nucleus within. This theory Mr. Reade subjects to a very thorough and crushing criticism. He insists upon applying to it strict arithmetical and mathematical tests, and shows, we venture to believe, most surprising flaws in the reasoning by which it has hitherto been sustained. Briefly put, the result of his investigation, on the destructive side, is to prove that no shrinkage sufficient for the purpose exists, and that the greatest conceivable shrinkage would be quite inadequate for the production of the effects ordinarily attributed to it. The reasoning in this controversial portion of his work, however, is so close and condensed that it hardly admits of presentation in a brief summary. Readers must turn for information to the work itself. On the constructive side, Mr. Reade opposes to the orthodox theory a new and most plausible hypothesis of his own. He begins by showing that periods of great sedimentary deposit precede the birth of every large mountain chain. Now Babbage proved long ago that an addition of sediment to any part of the earth's crust must raise the temperature of the subjacent mass which it covers and encumbers. The "isogeotherm" or line of equal temperature will therefore rise, and by a series of reactions, which Mr. Reade describes in full detail, will produce immediate results by expanding the new sedimentaries in every possible direction. But the tendency to expand horizontally is checked, of course, by the rigid mass of the earth's crust bounding the locally heated area. The heated area is, therefore, forced to expand vertically alone, and to form those ridging-ups of the surface which we know as mountain ranges. Mr. Reade, being himself a civil engineer of considerable experience, has experimentally determined the mechanical effects of expansion by heat on bars of various sandstones, marbles, and other like materials, and has proved that stone does actually ridge up under such circumstances so as to produce miniature mountain ranges. Being also an accomplished geologist, he has applied his theory to the explanation of large classes of facts in dynamical geology ; he accounts for the foldings of strata, the repacking of beds, and the production of faults, in a way which is certainly ingenious and appears to possess much plausibility as well. The thing hangs together with notable verisimilitude. His whole theory, indeed, proceeds upon the now familiar line of pointing out the vast cumulative effects of comparatively small and unobtrusive factors. As an example of the quantitative effect of a rise of temperature in a given area and depth of rock he takes a district of five hundred miles in length by five hundred in breadth. The crust to a depth of twenty miles beneath this comparatively small district would comprise five million cubic miles of rocky material. If this mass were heated to a mean of 1,000° Fahr.—a temperature which, says Mr. Reade, must have occurred over and over again in the local heating of the earth's crust—there would be an increase of volume to the extent of 52,135 cubic miles, which excess must necessarily rise in the arched or vaulted form of a mountain chain. Enormous as this result may appear at first sight, the block of crust here postulated is nevertheless only the $\frac{1}{31875}$ part of the solid matter of the whole globe. The mountain chain thus produced would be indeed but a very insignificant one ; the vast masses of sedimentary deposit out of which have been formed and carved the Alps, the Andes, the Rocky Mountains, and the Himalayas are spread out over enormously larger and wider areas. The greatest of mountain ranges indeed are but trifling excrescences upon the outer surface of our third-rate planet.

It would be premature to pronounce dogmatically upon the truth or error of Mr. Reade's startling hypotheses. They must be tested by time, and verified or disproved by the long and careful observations of working geologists. But whether true or not, there can be no doubt at all of their fundamental importance, their singular originality, their admirable elaboration, and the skill and ability with which they have been worked out and presented to our minds. His doctrine, in fact, is simply revolutionary. If he succeeds in convincing others, he will have altered our entire conception of dynamical geology. If he does not succeed, he will at least have aroused a wholesome scepticism

* "The Origin of Mountain Ranges." By T. Mellard Reade, C.E. (London : Taylor & Francis. 1886.)

and a ferment of inquiry which cannot fail to elicit fresh truths upon this difficult line of investigation. It is long since geological literature has been enriched by so able, so philosophical, and so profound a work.

Gossip.

By Richard A. Proctor.

A clerical reader asks me to insert these notes on my article on "The Beginning of Christianity." "They do not deal," he remarks, "with debateable matters or interpretations, but with simple facts":—

1. The Gospel of St. John does not contain a word bearing on the Quartodeciman dispute, though, strange to say, it is a not uncommon notion that it does.

2. In the wholesale rejection of all but five of the books of the New Testament you are not dealing with "ascertained facts," but accepting unreservedly the aggregate of theories supported by various critics, who display among themselves huge differences of opinion.

As to the second note, I remark that, in the article referred to, I have not accepted unreservedly or otherwise the opinion of Baur. I expressly spoke of those five books of the New Testament as proved to have been really written by those whose names are associated with them, which by no means implies any opinion as to the remaining portions of the New Testament. But elsewhere I have undoubtedly conveyed as mine the opinion that the three first Gospels cannot possibly have been written by those whose names they bear. It requires no study of Strauss or Baur, or other kindred critics, to find the clearest traces in the Gospels named after Luke and Mark that they belong to the beginning of the second century. The Gospel according to Matthew may have been in existence nearly in its present form as early as 80 A.D., while those passages in which reference is made to the second coming of Christ must have been written (and possibly by Matthew) shortly before the fall of Jerusalem—say somewhere between 60 A.D. and 70 A.D. By the time the second Gospel (by which I mean Luke's not Mark's) was written, it had become clear that the expectation of the approaching end of the world which, whether he had held it himself or not, Christ had certainly aroused in the minds of his followers (assuming as much of the narrative as we possibly can to be historical) had been delusive. The Gospel according to Mark is so manifestly compiled from the other two that its date must be set later than theirs. The only reason for setting it before the Gospel according to Luke would seem to have been some idea of explaining the opening words of the last-named narrative—though still leaving those words open to an exception akin to that suggested by Biondello, since Matthew and Mark, though they may be more than one, are yet not many.

* * *

My clerical critic's first note touches as little on what I actually wrote as his second. I certainly never suggested that the writer, or (if Arnold is right) the compilers, of the fourth Gospel wrote one word bearing on the Quartodeciman controversy. In the progress of that controversy, as every student of the history of early Christianity knows, many subjects were dealt with besides the altogether paltry Quartodeciman question itself. I write away from my books, being in the midst of the petroleum region of Pennsylvania on a lecturing tour, and am therefore unable to give details with all the accuracy I should desire. But I think I am right in saying that Polycarp, somewhere about the years 165, 166 (he was killed in 167), took part in the Gnostic controversy against Valentinus and Marcion. Irenæus, unless I mistake, mentions that Polycarp quoted against the Gnostics the words of John the Apostle. And it is certain that Justin, somewhat earlier (he was killed in 164), did *not* quote John in favour of Gnosticism. Yet the Gospel according to John is not only obviously not by John, and not in the slightest degree "according to" the intensely anti-Pauline John of the Apocalypse, but is ably and powerfully Gnostic. Throughout the period during which the Quartodeciman controversy was in progress, the authority of the fourth Gospel in favour of Gnosticism would have been repeatedly quoted had the Gospel then been recognised as canonical—nay, had it even existed. The "Fragment of Muratori" showed that it existed very soon after, and the Gnostics took care that it should quickly be recognised as of authority. But the fact that Polycarp had quoted John the Apostle against the Gnostics can never be reconciled with the alleged authorship of the fourth Gospel—apart from the obvious difference between the ideas of its writer and those of the writer of the Apocalypse.

* * *

Of course the evidence is also clear that the fourth Gospel could not have been written by a Jew. To mention but one striking proof of the foreign authorship, the three oldest original manuscripts have "Bethany beyond Jordan" where the later writers ingeniously substituted "Bethabara." Now, as Matthew Arnold points out (I think in his "God and the Bible"), a Jew would be about as likely to speak of "Bethany beyond Jordan" as an Englishman to speak of "Willesden beyond Trent," Bethany being a suburb of Jerusalem, and Jerusalem not within twenty miles of the Jordan.

* * *

The actual Quartodeciman controversy related, of course, to the absurdly trivial question whether Easter Day should be wholly determined by the Jewish Passover, or so far regulated by Christian rules as to fall always on Sunday. On this matter the Eastern and Western Churches took opposite sides, and adhered to their opposite opinions with a resolution worthy of a better cause. The fourth Gospel only indirectly suggests any opinion on the question. The writer, whoever he may have been, always speaks of Jewish ceremonials like a Gentile, not like a Jew; and we may infer that his opinion on the great Fourteenth Day controversy would have been in favour of the decision adopted by the Eastern Church, according to which the strictly Jewish usage was abandoned in favour of a half-Jewish, half-Christian compromise.

* * *

The following letter has been addressed to the publishers of Knowledge by another clerical correspondent:—

In the last number of Knowledge there is an article on the "Beginning of Christianity," by Mr. R. A. Proctor, in which the following passage occurs:—

"Even so strange a circumstance as the crucifying of three persons, of whom two died but the third was restored to life, actually happened to the knowledge of Josephus, who describes the event in the most natural manner: but it happened long after the time of Pontius Pilate, and the three who were crucified were Josephus's personal friends."

Would you have the goodness to ask Mr. Proctor his authority for saying this?

On the event referred to Josephus writes thus:

"Now there was about this time Jesus, a wise man, if it be lawful to call him a wise man, for he was a doer of wonderful works, a teacher of such men as receive the truth with pleasure. He drew over to him both many of the Jews and many of the Gentiles. He was [the] Christ. And when Pilate, at the suggestion of the principal men among us, had condemned him to the cross, those that loved him at the first did not forsake him: for he appeared to them alive again the third day, as the divine prophets had foretold these and ten thousand other wonderful things concerning him. And the tribe of Christians, so named from him, are not extinct at this day." (Book xviii. chap. iii. of the small edition of Whiston's translation of Josephus.)

* * *

The passage here quoted is the now notorious interpolation, too clumsily managed to deceive any, since it contradicts the whole tenor of Josephus's writings in regard to the promised Messiah, and, indeed, makes Josephus's whole life self-contradictory. Even Canon Farrar, whose receptivity in such matters is remarkable, says of the passage, it is "interpolated if not wholly spurious"; and again, "Josephus did not choose to make any allusion to facts which were even remotely connected with the life of Christ." (See Farrar's "Life of Christ," chap. vi. 3.)

* * *

The passage to which I referred runs thus:—

"As I came back" (from Teckoah) "I saw many captives crucified, and remembered three of them as my former acquaintance. I was very sorry at this in my mind, and went with tears in my eyes to Titus and told him of them; so he immediately commanded them to be taken down, and to have the greatest care taken of them, in order to their recovery; yet two of them died under the physician's hands, while the third recovered."

* * *

My "authority" for this is Josephus (see edition above mentioned, "Life of Josephus," section 75). It should be remembered that this account of the resuscitation of one of three crucified persons, under the care of Joseph the Asamonean, was published at least a quarter of a century before the account in the Gospel "*according to* Matthew," of how Joseph the Arimathean went to Pilate and begged for the body of Jesus, that one of three crucified persons whose restoration to life that Gospel records.

* * *

Not ten years have passed since Brigham Young died. Hundreds saw him dead, and all the circumstances of his last illness and death are known. It will hardly be believed that in these matter-of-fact days the believers in Young, as chief of the Latter Day Saints, assert that he is now alive again.

* * *

Since Mr. Boss started, and Professor Piazzi Smyth adopted, the mistake into which several others (I being one) rather naturally fell, of regarding the comet of 1882 as the same body as the comets of 1880, 1843, and 1668, I have maintained the probability that all these comets were originally one, which was dissipated into several components long ago, and that more fragments may still arrive. It seems as though the large comet recently discovered confirms the justice of this suggestion, for it is travelling in the same track near the sun as was followed by the comets of 1668, 1843, 1880, and 1882.

* * *

I recently had occasion to note, in connection with this same comet of 1882, a curious illustration of the unfair way in which men are apt to be treated who announce and correct their own mistakes as freely as they would those they had detected in the work of others. It was, as is well known, Mr. Boss in America who, immediately after the discovery of the comet of 1882, started the idea that it was the comet of 1880 and 1843 come back again. Professor Piazzi Smyth eagerly seized the notion, because it confirmed, as he thought, his belief that the end of the world was to be brought about at this time, the second coming of Christ (which Christ himself, according to the Gospels, regarded as "the end of the world"), being definitely announced by the grand gallery of the Pyramid of Cheops, for July 1882. But others fell also into the error, at that time a very natural one, of supposing that the practical identity of the perihelion parts of those comets' orbits implied the identity also of the comets. I was one of these; Mr. Hind, of the *Nautical Almanac*, was another. I was the first to point out that we had been deceived. The coincidence in question could not be accidental; *but* also it could not be explained as we had endeavoured to explain it.

* * *

But because I, being neither the first nor the second to fall into a certain very natural mistake, was the first to indicate its nature (and have been alone, to the best of my knowledge, in carefully announcing and correcting it), it appears that many have fallen into the by no means natural error of supposing that to me belongs the chief discredit, such as it may be, for making the original mistake. Recently, an ardent admirer of Professor Smyth's pyramidal theories, having occasion to fall foul of me because I regard the stone bible theory of the pyramid as erroneous (to begin with, and a trifle blasphemous, to go on with), took occasion in a magazine of his, called *Ford's Christian Repository*, to proclaim lustily that my opinion need not be regarded as of any weight, since I had made this particular error, whereof he spoke as of a blunder by which I had notoriously incurred discredit. Of course, this gave one some interesting amusement in opening the Rev. Mr. Ford's highly Christian optics, by first showing how unimportant the mistake really was, and then mentioning casually that, such as it was, his *protégé*, Professor Smyth, had had much more to do with its adoption than I had. But I venture to insist that while making mistakes proves (according to the true saying of Liebig) that a man's mind is fecund—the man who makes no mistakes being necessarily a dullard—acknowledging a mistake frankly, fully, and early, should engender confidence not doubt in the man who has thus erred and admitted it.

* * *

"Show me a man who has made no mistakes," said Liebig, "and I will show you a man who has discovered nothing." Show me a man, I would add, who has never acknowledged a mistake, and I will show you one who, unless he be one of Liebig's dullards, is dishonest and untruthful. He has done more harm to science by bad example than could be repaid by any number of brilliant discoveries.

* * *

It is strange how weak some men are about this matter of recognising and admitting error. Unfortunately the weaklings in this respect judge others by themselves. I have a friend (supposing I have not lost him of late) who up to some ten years since scarcely let a month pass without some noteworthy discovery, and whose work therefore I never tired of dwelling upon with enthusiasm. But during the last ten years or so he has announced no discoveries of any interest (if any at all), and naturally I have been silent. A year ago I went so far as to suggest, with complimentary reference to his past achievements, a hope that we should soon hear of others as noteworthy—especially as he has been placed in charge of a much more powerful telescope than he formerly had. Ever since, he has laboured under the truly amazing idea that I no longer praise his work because he has not yet accepted my theory of comets and meteors! Among those who read these lines there must I think be many thousands who within the last year have read and heard many enthusiastic words of mine in regard to this erst earnest observer's work in the past. Let him give me any new work to "enthuse" over, and he will quickly see whether I am colder than of yore.

* * *

Rather amusingly, I read within a few hours of sending off my remarks on "Prize Competitions" a cablegram in the *New York World* mentioning two lists of "Forty" drawn up by readers of the *Pall Mall Gazette*, in one of which my own name is included. I do not learn from the paragraph whether anything in the circumstances may make these lists of Forty entirely imaginary Academicians differ from those on which I have commented. But, in any case, I must fully and unaffectedly disclaim all pretensions to anything even tending towards the "celebrity" supposed to be suggested by such lists as these. Except my treatise on "Saturn," which has reached few, my still more fascinating "Geometry of the Cycloids," which has reached fewer, and one or two atlases which are, I hope, useful, everything I have yet published has merely indicated the course those studies of mine have taken, which I hope to embody in a treatise on astronomy now nearly a quarter of a century in preparation. Either my name illustrates very effectively the argument in my paper on "Prize Competitions," or it has been added to these lists by way of a joke—unless some few have seen, very far ahead, the real purport of my inquiries in astronomical matters.

* * *

A correspondent informs us that Mr. Henry L. Ward, a rising young naturalist of Rochester, N.Y., has recently secured several specimens of the West-Indian seal (*Monachus tropica*) which had long been thought extinct.

* * *

From *Punch* the facetious (?)—

Lilly writes brightly
In the *Fortnightly*,
Meaning sharp Huxley to settle;
Huxley looks silly,
Finding his Lilly
Turns out a stinging-nettle.

Mr. Lilly is a Roman Catholic, so is Mr. Burnand, editor of *Punch*, author of "Happy Thoughts" and other philosophical works; hence Mr. Burnand's fitness to judge and impartiality of judgment.

Bacon and Modern Science.—Whatever debt the world of science may owe to Bacon, it was not the invention of the method of research by which all great discoveries in science from long before Bacon's time till now have been effected. Yet, if we are asked in what way Bacon helped the progress of science, and in what degree, our answer must speak very strongly in his favour, though we must reject the false notions commonly entertained. Unquestionably Bacon's two great works, the "Instauratio Magna" and the "Novum Organum," gave an immense impulse to the development of science *in England—not* by their influence on scientific workers and thinkers, not five in a hundred of whom have ever studied those works, but by the general attention which they directed to the prevalent faults of the methods in vogue when they were written. A false syllogistic system, applied to imperfect or insufficient evidence, offended justly the clear mind of Bacon: he attacked and overthrew that method, and though he was no student of science himself, in any true sense of the word, though his ideas about matters scientific were mostly erroneous and his knowledge of the science of his day most imperfect, yet by his advocacy of the true general principle that Nature will reveal her secrets only in response to sedulous and reiterated inquiries he moved the mass of thinking men to adopt a truer method of research. They did not adopt the method carefully defined and described by Bacon: they did not even adopt a new method; but as a body they became disciples of the true school which, when Bacon wrote, had been exiguous in the extreme.

Reviews.

The Cruise of the Marchesa to Kamschatka and New Guinea. By F. H. H. Guillemard, M.A., M.D. (John Murray.)—These sumptuous volumes are a worthy addition to the standard works of travel issued from the historic house in Albemarle Street. Dr. Guillemard writes in a clear and animated style: the scenery which he describes is brought vividly before us in superbly executed woodcuts from his photographs, and the route is easily followed by the aid of many excellent maps. The cruise of the *Marchesa*, an auxiliary screw schooner of 400 tons, extended from January 1882 to April 1884, during which period regions, already known to us through the graphic narratives of Mr. Alfred Wallace and other explorers, were visited, and concerning which Dr. Guillemard therefore exercises wise brevity, while other regions, less familiar, give ample employment to his pen. The voyage, in its scientific results, was successful, 3,000 specimens of birds and a large collection of insects being secured, the birds from Sulu including a hitherto unknown species of bush-shrike, which is the subject of one of the two richly-coloured frontispieces. Another find was in New Guinea, where Dr. Guillemard, whose chief object there was to procure birds of paradise, had the good fortune to capture an echidna, or spiny ant-eater, over two feet long, and therefore larger than its Australian representative. Touching at Formosa, the precipices of which are more imposing than even the cliffs of the Yosemite valley, and the former connection of which with North India and Sumatra is proved by the similarity of its fauna, the *Marchesa* paid a flying visit to Japan on her voyage to Kamschatka. The chapters on the history, physical character, and fauna of this peninsula, with its thick forests, its belt of eruptive volcanoes, the highest of which is nearly 16,000 feet, its far-extending *tundras*, its hybrid population so thinly scattered that the doctors in their long rounds leave the sick physic enough for a year, and its salmon-snaring rivers, are full of fresh and entertaining matter, the more welcome, as there is little of adventure wherewith to enliven the volumes. The visit to New Guinea was confined to its Dutch or western half, and such fragmentary notes as are given concerning the mop-headed Papuans and their customs and beliefs are useful additions to our scanty knowledge of an island which has yet to be fully explored. The houses built on the piles by the waterside, the holes in their flooring for the refuse to be thrown away, and the curious crescent head-rests, which latter occur in Egypt and elsewhere, give reality to the ancient life of the lake-dwellers described by Herodotus, and reconstructed in Dr. Keller's researches. But enough has been said to commend Dr. Guillemard's volumes to our readers.

An Arctic Province: Alaska and the Seal Islands. By H. W. Elliott. (Sampson Low & Co.)—Kamschatka is the land of the sable and the salmon; Alaska of the fur seal. Twenty years ago the United States of America gave Russia seven million dollars for the territory of Alaska, a land of bewildering indentations, endless coast-line fringed with thousands of islands and islets, beaten by wind and waves, scarred by volcanic eruptions, enveloped in persistent fog, and cursed by mosquitoes—a region so gloomy that "the good Bishop Veniaminov, when he first came among the natives of the Aleutian Islands, ordered the curriculum of hell to be omitted from the church breviary, saying, as he did so, that those people had enough of it here on earth." Mr. Elliott's volume is encyclopædic in its details of the features of this desolate, pitiless land, and of life among the Indians whose rancheries, each with its oddly-carved post displaying the totem of the owner, are grouped into more or less permanent settlements near the great fishing-grounds, every village being governed by its unwritten code, disobedience to which lays the offender open to reprisals by the offended. Though the forests teem with animal life, goats, deer, and grouse, the natural indolence of the native limits him to the easier work of fishing, except where the high prices offered by the white traders for the prized skins of the rapidly-diminishing sea-otter tempt the hunters to its exciting and hazardous pursuit. The most interesting and valuable chapters are those which describe the fur-bearing animals of the Pribylov Islands, a volcanic group in Bering Sea. The most highly organised of these creatures is the fur-seal, "indeed, when land and water are weighed in the account together, there is no other animal known to man which may be truly classed as its superior from a purely physical point of view." Mr. Elliott writes with the authority of an expert, and the account which he gives of the several species of pinnipeds found in the seas round Alaska is very complete, while his chapter on the struggle between the males for possession of the breeding-grounds, or "rookeries," as they are called, supplies important evidence in favour of Darwin's theory of sexual selection. We regret that space prevents quotation from his graphic account of the terrible combats between the bulls for the few feet of rock on which they await the coming of the cow-seals, the average number of which in the harems is from twelve to fifteen. Altogether, this is an honest and veracious book, though somewhat laboured in style, and with illustrations of unequal merit. It should be read in conjunction with Dr. Guillemard's volumes as dealing with countries in close contiguity.

The Factors of Organic Evolution. By Herbert Spencer. (Williams & Norgate.)—This is a reprint, with additions, from the *Nineteenth Century* of April and May last. It is intended to be supplemental to Mr. Darwin's theory, and we may call special attention to the sections treating of the general and constant operation of surrounding agencies on the organism, and of the direct action of the medium as the primordial factor of organic evolution. The following extract gives the gist of Mr. Spencer's argument :—

In the primordial units of protoplasm, the step with which evolution commenced must have been the passage from a state of complete likeness throughout the mass to a state in which there existed some unlikeness. Further, the cause of this step in one of these portions of organic matter, as in any portion of inorganic matter, must have been the different exposure of its parts to incident forces. What incident forces? Those of its medium or environment. Which were the parts thus differently exposed? Necessarily the outside and inside.

Sonnets on Nature and Science. By S. Jefferson. (Fisher Unwin.)—Among the many themes which inspire the author's limping muse are the Amœba, Seismic force, the Equinoctial gales, the Nebular Hypothesis, and the Luminiferous Ether. Concerning this last the poet sings :—

No chemist knows of what this gas consists,
The physicist its minute waves may count,
And trace their course across the deep profound,
For science can but say that it exists,
That, almost infinite in its amount,
It fills the wide extent of Cosmos round.

Slightly altering a quotation from Lord Byron, we may safely predict that Mr. Jefferson's sonnets will be read when Wordsworth and Shelley are forgotten—but not till then.

Evolution and Creation. By H. J. Hardwicke, M.D. (Purton Lodge, Sheffield; published by the Author.)—Dr. Hardwicke is for the most part his own printer and artist, and the result is more or less a hotch-potch. The unattractive look of this volume should not, however, affect our judgment of its contents, the essays on "Man's Antiquity" and the "Evolution of Mind" being well and clearly written. In his remarks on the "Evolution of the God Idea" Dr. Hardwicke is a less trustworthy guide, his philology, *e.g.* the discussion on the word *God*, being unsound, and his leading authorities more or less discredited.

Essentials of Histology. By E. A. Schäfer, F.R.S. (Longmans.)—Histology is the science which treats of the minute structure of tissues and organs, and Prof. Schäfer's work is written with the double object of serving as an elementary text-book of histology and of supplying the student with directions for microscopical examination of tissues. The work, in our judgment, is complete both in its exposition of the subject and in its instructions to students, while the illustrations, both borrowed and original, are admirable.

Society in the Elizabethan Age. By Hubert Hall. (Swan Sonnenschein & Co.)—Mr. Hall has made industrious use of his official connection with the Public Record Office to collect material from its stores for social sketches of England three hundred years ago. But, in place of a broad sketch of the town and country life of that period, such as the title of his book leads us to expect, Mr. Hall gives a series of representative portraits, comprising the landlord and tenant, the courtier and bishop, the civil servant, lawyer, and burgess of the time. On the whole, this method of isolation is disappointing, causing the work to lack both cohesion and perspective. With such materials to work upon, Mr. Hall could not fail to bring together many curious and interesting items, from which the pens of more ready writers may elaborate a worthy picture of the England of Elizabeth. The volume is prefaced by an admirable map of London from Cheapside to "St. Jemes Park."

The Folk Songs of Italy. By Miss R. H. Busk. (Swan Sonnenschein & Co.)—The accomplished authoress of "The Folk Lore of Rome"—of which scarce book a reprint would be welcome—now brings from her treasury, in which the collections of twenty years are garnered, specimens of folk songs from all parts of Italy, the place of honour being given to the songs of Sicily. Like the *Volkslieder* in Germany, they fill the Italian air, although Miss Busk utters the old lament that the songsters of every degree, from the prima donna to the peasant, are daily becoming rarer. "The old folk rhymes, which are nearly always the utterance of pure and holy affection, are now only met in country nooks; the townspeople, if they sing at all, are provided with another class of songs which we should not care to read." The more important and praiseworthy, therefore, is the task which Miss Busk has valorously undertaken—a task the difficulty of which, in the face of the seven hundred dialects in which the songs exist, is enormous. The principles which have governed her in selecting and translating are set forth in the Preface, which explains the leading features of the several classes of songs, and is enriched with a pathetic sketch of Beatrice Bugelli, one of the latest peasant poets. Miss Busk has earned the gratitude of all lovers of lyrical verse and folk-lorists for this delightful and daintily-printed little volume.

Tales of the Caliph. By Al Arawiyah. (Fisher Unwin.)—A series of ingenious tales relating adventures supposed to have happened to the Caliph Haroun Al Raschid, or to persons whom he met in his usual night rambles *incognito*. No claim of derivation from original Oriental sources is made on behalf of these tales, hence the absence of strict fidelity to local colouring. The last story is amusing, although the idea is not novel. The unlucky possessor of a magic tube, peeps into which reveal the future, describes a vision of telegraphs and railways to the Caliph, who, enraged at his monstrous inventions, orders him to immediate execution.

She. By H. Rider Haggard. (Longmans.)—"She" already numbers its readers by thousands; it has provoked a parody in which the deft hand that wrote "Much Darker Days" is traceable, and, moreover, an explanation from Mr. Rider Haggard of the esoteric teaching of the wonderful story. We confess that we do not greatly care to know that the lessons intended to be conveyed in the career of Ayesha are the deathlessness of deep love and "the probable effects of immortality working upon the known and ascertained substance of the mortal," Ayesha's insolent menace against Omnipotence, as her hardness and cynicism grow with the creeping centuries, being punished by the terrible fate described in the story. The fertility of invention characterising "She" delights and enthralls us, and, moral or no moral therein, we read it with interest that deepens as the tale advances to the awful sequel. But Job, who is intended as a comic set-off against the graver characters, is an irritant, and the story would gain by his removal.

Books and Bookmen. By Andrew Lang. (Longmans.)—Books about books have a perennial charm, and bibliophiles may without hesitation accord Mr. Lang's new volume brevet rank as a worthy comrade with his former book on "The Library," and with Dr. Hill Burton's classic "Book-Hunter." The book collector is on a lower plane than the lover of literature, to whom the form is nothing, the spirit everything. But although the accident and not the essence, the clothing and not the soul, make the book dear to the collector, his functions are more useful than his intentions, since his care for the lesser secures the preservation of the greater. Mr. Lang, we need scarcely say, does not value books for their externals alone, and in the limits which he has set himself gossips in chatty, learned fashion, the learning being dropped in in his happy allusive way, about the true and spurious in the famed Elzevirs; about the art of the old binders, notably the French; about title-pages, quaint specimens of which are given in facsimile: and then wanders off to gossip on parish registers and literary forgeries. To the volume is added a reprint on "Japanese Bogie Books," from the *Magazine of Art*, with gruesome illustrations of a storm-fiend and a well-and-water bogie, limp and washed out, with drooping and dripping arms, perchance a washer of dead men's linen in the moonlit pools and rivers. Mr. Lang tells us he has spared our nerves in not venturing to copy yet more awful specimens of Oriental spectres.

The Arithmetic of Electrical Measurements. By W. R. P. Hobbs. (London: Thos. Murby.)—This little book will be found handy by everyone engaged in the economic application of electricity. It contains a large number of numerical examples of the strength of current, and of resistance produced by arrangements described in the text. In the outset an illustrative example or two are worked out at length, and then a series of questions are set for exercise.

An Elementary Text-book of British Fungi. By Wm. Delisle Hay, F.R.G.S. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—Here is another botanical work, addressing even a larger public than that of Professor Strasburger. For the chief end proposed to himself by Mr. Hay is the description of fungi in their economic aspect—a subject of great and growing interest to all who wish to find some cheap nitrogenous substitute for the butcher's meat which has become so needlessly costly; to say nothing of the *gourmet*, to whom many an unknown and unsuspected form of "toadstool" will come as a delicious esculent. Among the most valuable chapters in the book may be mentioned the one on the discrimination of edible fungi; that on the chemistry and toxicology of fungi; while in the Appendix no less than 133 recipes for cooking mushrooms and other fungi are given. The very numerous engravings are beautifully executed. If the circulation of this volume is commensurate with its popular interest, it should surely be very considerable.

Celestial Motions: A Handy Book of Astronomy. By Wm. Thynne Lynn, B.A., F.R.A.S. Fifth edition. (London: E. Stanford. 1887.)—We need only note here that in this fifth edition of Mr. Lynn's excellent little book (of which we have on previous occasions spoken in terms of praise) the information is brought down to the very latest date, and that a chapter has been added on the refraction, propagation, and aberration of light.

God and His Book. By Saladin. (London: W. Stewart & Co.)—By unseemly flippancy, and irrelevant levity, "Saladin" seriously weakens a case which is, to a considerable extent, irrefutable. Many of his readers who will be unable to find any valid reply to his objections, will be repelled by the tone in which they are advanced, and he will thus excite hostility in some whom a different style of argument might have converted into allies. Notably will he raise antagonism in cultured students of his book, to whom his "chaff" (we can find no more appropriate word than this slang one for it) will be revolting. There can be no doubt that the calm, pitiless, unimpassioned marshalling of facts in "Supernatural Religion" has done more to shake the foundations of the faith (or credulity) of thousands who, prior to its perusal, were models of orthodoxy, than all the irreverent jests of "Colonel" Ingersoll and his school put together. We are the more disposed to regret the general style of the volume before us when we find—as in one or two of the chapters towards the end of the book—to what a height of pathos and real eloquence its author can rise when he chooses.

The Young Carthaginian: or, A Struggle for Empire. By G. A. Henty. (London: Blackie & Son. 1887.)—It is scarcely an exaggeration to say that this capital story of Mr. Henty's is the very model of what a boy's book ought to be. There is not a single dull page out of all its 384, for it is full of incident from beginning to end. We will not spoil the enjoyment of any of the thousands of lads who, we hope and believe, will soon have this volume in their hands, by anything like a *précis* of the stirring adventures of the young Carthaginian nobleman Malchus, who is the hero of the tale. Suffice it to say that he undergoes a series of most exciting ones, which, however, are strictly sequent, and arise perfectly naturally out of one another. Mr. Henty has obviously taken great pains to be archaeologically correct in all his details, with the result that we seem to see his characters as living men and women before us, and to be face to face with the dead-and-gone form of civilisation of 2,000 years ago. One thing we may safely predict in connection with the volume before us, and that is that everyone who reads it will assuredly go back to his "Cornelius Nepos," or his "Livy," with a zest for information as to the lives of Hannibal, Hamilcar, and their compeers, to which, in connection with his former mere "grind," with the Latin Text and his Dictionary, he was a total stranger. We have one very trivial fault to find with the book. It is this, that the illustrations are scarcely worthy of the text. The only one that seems to us to exhibit much artistic feeling is that facing p. 210.

Studies in Microscopical Science. Edited by Arthur C. Cole. (Birmingham: Hammond & Co.).—There is no falling off in the interest and value of this serial, which we heartily commend to young biologists. We have also to acknowledge the current issues of *The Century* and *St. Nicholas* magazines, which maintain their standard of excellence: *Hazell's Magazine*, written chiefly by Messrs. Hazell's staff, the March number containing a reproduction of an excellent photograph of Mr. Ruskin; the *Medical Annual* for 1887; the first numbers of Dr. Robert Brown's *Our Earth and its Story* (Cassell's), which opens attractively and well; and of the *Classical Review* (David Nutt); *Science and Education*; and *Proceedings of American Philosophical Society*, July 1886. Of the making of school books there is no end, but the space for their acknowledgment has its limits. Messrs. Swan Sonnenschein send us a capital *Arithmetic for Children*, by A. E. A. Mair; from Messrs. Moffat we have *Letters and Themes for Composition*, and *Drawing Copies* for Standards III. and IV.; from Messrs. Relfe Brothers the *Spelling Series of Copy Books*, which should be helpful to correct spelling; *German Exercise and Copy Book* and *Combination Exercise Book for Analysis and Parsing*. *Walford's Antiquarian* (Redway) continues to improve in its sprightly treatment of subjects too long in the hands of Dr. Dryasdust. Messrs. Smith & Elder bring up the rear with a pretty and compendious reprint, uniform in style with their pocket edition of Thackeray, of *Poems by E. B. Browning*, embodying all the alterations made for the edition of 1856.

Our Chess Column.

By "Mephisto."

VICISSITUDES OF PAWN AND TWO OPENING.

THE following two games were recently played in the Handicap Tournament now progressing at the British Chess Club. In Game No. 1 the second player wins: in Game No. 2 the first player proves victorious. We print these games together by way of contrast. In the first game the receiver of the odds fails to obtain any advantage in the opening, and soon succumbs to a strong attack. In the second game the reverse occurs: the odds-giver is quite unable to bear up against the advantage gained in the opening by the receiver of the odds, and has speedily to yield to inevitable defeat. These apparently contradictory results may, however, be sufficiently explained by the play of the respective players. In the first game the receiver of the odds plays the opening weakly, but the odds-giver fights well: whereas in the second game the receiver of the odds plays well, but the odds-giver very indifferently; and it is this curious combination of good and bad play, in reverse order, in both games which has produced correspondingly reverse results.

Game No. 1.—Success.

Remove Black's KBP.

White, Amateur.	Black, Mr. Zukertort.
1. P to K4	1. . . .
2. P to Q4	2. P to K3
3. B to Q3	3. P to B4
4. B to K3	

As the sequel shows, this move loses time, by allowing Black to develop. Either 4. P to QB3 or P × P are better than this.

4. P × P

5. B × P 5. Kt to QB3

Black has gained a very important move.

6. B to B3 6. Kt to R3!

7. Kt to Q2

Kt to KB3 is better; it prevents P to K4 for the moment.

7. P to K4

Whenever the odds-giver can safely play P to K4 then he has already overcome the principal difficulty in this opening.

8. Kt to K2

Weak again.

8. B to B4

Black is now becoming aggressive; he threatens to follow this up with Kt to KKt5, after which various possibilities of attack would present themselves either by castling or Q to R5, or P to KR4, &c.

9. P to KR3

Considering the above circumstances, perhaps not an unwise precaution.

9. Castles

10. Kt to B3 10. P to Q3

11. B to Q2

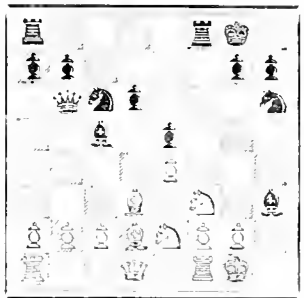
Poor Bishop! wandering aimlessly and regardless of the aggressive spirit of the times.

11. Q to Kt3

Taking the best advantage of White's play.

12. Castles 12. B × RP!

Black.



White.

This move proves fatal to White's future chances.

13. Kt to B3 13. B to KKt5

14. Kt to QR4

Either Kt to Q5 or B to K2 were requisite, it would have prevented Kt to Q5 by Black.

14. Q to B2

15. Kt × B 15. P × Kt

16. Q to B sq.? 16. B × Kt

17. P × B 17. Kt to Q5

This practically decides the issue.

18. B × Kt 18. P × B

19. Q × P 19. P to B5!

And Black won in a few moves.

Game No. 2.—Failure.

Remove Black's KBP.

White, Amateur.	Black, Mr. Gunsberg.
1. P to K4	
2. P to Q4	2. P to Q3

It is very difficult to follow this move up properly, and any deviation from the well-known lines of play should particularly be avoided by the second player.

3. B to Q3 3. P to K3

3. B to K3 is sometimes played here.

4. P to K5 4. Kt to K2

A weak move, which enables White to develop well. P to KKt3 was now necessary.

5. B to KKt5! 5. P to KKt3

6. P to KR4 6. QKt to B3

Perhaps P to Q4 would have provided Black with a loophole for his K on Q2.

7. P to R5! 7. R to KKt (sq)

Black would not play 7. P × P on account of 8. Q × P (ch), K to Q2, 9. P to Q5! Then again, 7. Kt × P would likewise result badly for Black.

8. P × P 8. P × P

9. P to KB4 9. P × P

10. QP × P 10. Q to Q5

11. Kt to QB3 11. B to Q2

Black having gained breathing time does not make the best of it, Q to Kt5 would have gained further time perhaps, and brought the Q away.

12. Q to K2 12. Castles

13. Castles 13. Q to Kt5

Black is now compelled to make this move, and lose time by doing so.

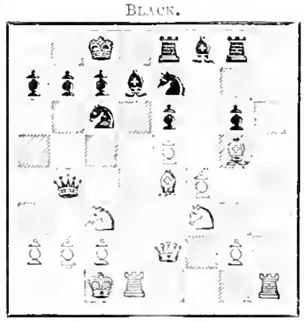
14. Kt to B3

White brings all his pieces well into play, and does not hurry his attack.

14. R to K sq

15. B to K4!

Black.



White.

A good move, and the beginning of a combination well planned and executed, which speedily turns the game in White's favour.

15. Kt to B4

This proves loss of time; there is nothing but Kt to Kt sq., with the hope of being able to free his game perhaps by B to B3.

16. Q to Q3! 16. Kt to Kt sq.

17. R to R7!

Taking forcible advantage of the position

17. Kt to K2

B to Kt2 might perhaps have delayed the game longer, but the position was bad, as White then threatened 18. P to Kt4, followed by 19. P to QR3, and 20. Kt to KR4, &c.

18. Kt to R4

The best? The position is a very curious one. White threatens more than merely to win a P, for after 19. Kt × P, Kt × Kt, 20. B × Kt, the Rook has no move. But there are many interesting variations possible in this position which the reader may examine, such as 19. B × P, Kt × B. 20. Kt × Kt, and the Black B on Q2 cannot move or be defended, as White would mate on Q8. Then again, Black cannot now play 18. B to B3, as White would reply with 19. B × P, and the Black knight cannot retake.

18. P to B4

For want of a satisfactory move, it avoids the mating possibilities.

19. P to R3	19. Q to R4
20. Kt × P	20. KKt to B3
21. Kt × B	Resigns.

For if Black retakes, then 22. R × B makes the game hopeless for Black.

Hindoo Cosmogony and Physics.—The Rev. Sumangala, chief-priest at Adam's Peak, in Ceylon, has recently published an account of the opinions of Hindoo astronomers on the form and attraction of the earth. Bhaskara, who flourished in the twelfth century, thought that the terrestrial globe, composed of land, air, water, space, and fire, had a spherical form, and, surrounded by the planets and the orbits of the stars, maintained itself in space by its own power. This, he says, is in fact demonstrated. Lands, mountains, gardens, and houses cover the earth as pollen covers the flower of Kadamba, and serve as the homes of men, Raksasas, Devas, and Asuras. He rejected the idea that the earth rested on anything else, for the obvious reason that, if another support were needed, there would be no end to the supplementary supports. Therefore we shall have to admit a final equilibrium somewhere; why not accept it at once? "Is not the earth one of the forms of Siva? As heat occurs naturally in the sun and fire, cold in the moon, fluidity in water, and hardness in the stone, so mobility exists in the air. Every object has its own properties, and the properties implanted in some objects are wonderful." Bhaskara believed that the earth, possessing an attractive force, drew to itself everything heavy in the atmosphere surrounding it, whence those bodies fall to it. "But," he said, "how could the earth fall into the ethereal space, since that space is equal on all sides?"

Our Whist Column.

By "Five of Clubs."

ILLUSTRATIVE GAME.

The following game is sufficiently simple; but it serves to illustrate well the necessity of care in supporting partner's strategy and attending to details. Had *B* misunderstood *A*'s play in turning from trumps to his long plain suit, *A*'s purpose would have been foiled, and, though *A*–*B* would still have come out ahead, the game would have been missed. *Z* could have saved the game by boldly leading *A*'s established suit, but only by a single point.

THE HANDS.

B { H. (*trumps*).—Q, 6, 2. C.—8. S.—A, 10, 8, 7, 5. D.—K, 8, 6, 3. }

Y { H. (*tps*).—K, Kn. C.—9, 7. D.—Q, Kn, 10, 5. S.—K, Q, Kn, 9, 6. }

B

Y Z

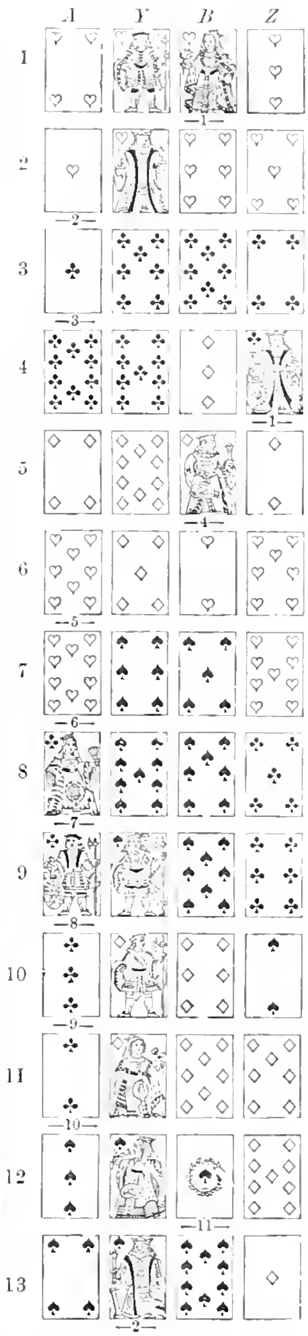
Tr. H. 9.

A leads.

Z { H. (*tps*).—9, 7, 5, 3. C.—K, 6, 5, 4. D.—A, 9, 7, 2. S.—2. }

A { H (*trumps*).—A, 10, 8, 4. C.—A, Q, Kn, 10, 3, 2. S.—4, 3. D.—5. }

A B play against *Y* and *Z*. Score:—*A B* none; *Y Z* none.



NOTES ON THE PLAY.

Card underlined wins trick; card underneath leading next.

1. *A* properly leads trumps, with his splendid Club suit, and strength enough in trumps to give a good chance of bringing in his long suit.

2. From the return of the Six, *A* knows that his partner—who certainly holds the Two (see first round)—held only three originally. Hence he sees the minor tenace in *Z*'s hand, and that *Z* must be led through by *B*, if possible.

3. *B* now knows that, besides the second best trump (the trump card), *Z* must hold the fourth best. For, unless *A* held the major tenace as against the minor tenace, declared in *Z*'s hand, *A* would go on with trumps.

4. For *B* to ruff here would have been very bad play, though it is what nine out of ten who imagine they play whist would have done without hesitation. *B* can place all the trumps, and *Z*'s King will inevitably make some time or other. But, apart from that, *B* can see that *A*'s whole strategy will be ruined unless *A*'s long suit can be established and *Z* led through in trumps. With Ace of Spades and his well-guarded Diamond King, *B* is pretty sure to get the desired lead.

5. *Z* should here have seen the danger of the position, and that his best chance is to throw the lead into *A*'s hand. If *B* gets a lead neither of *Z*'s trumps can make, so that if *A* is driven to force *Z*, the trick so made will be clear gain, even if nothing more is obtained.

6 to the end. The game now plays itself; and the wisdom of *B*'s course in refraining from the tempting ruff at trick 4, or rather the folly he would have displayed had he ruffed at that point, is clearly seen: *A*–*B* make five by cards and the game.

If *B* had ruffed at trick 4 the game would probably have proceeded as follows:—

	A	*Y*	*B*	*Z*
4.	C 10	C 9	H 2 —4—	C 5
5.	S 3	S 6	S A —5—	S 2
6.	S 4	S 9 —1—	S 7	D 2
7.	H 8 —6—	S K	S 5	D 7
8.	C Q	D 5	D 3	C K —2—
9.	C Kn —7—	D 10	S 8	C 6
10.	H 10 —8—	S Kn	D 6	H 7
11.	C 3	S Q	S 10	H 9 —3—
12.	C 2	D Kn	D 8	D A —4—
13.	D 4	D Q	D K —9—	D 9

7. *Y Z* do better if *Y* here leads Diamond Queen; but it would be bad play so to lead; for the lead of Spade King saves the game surely; whereas, for anything *Y* knows, the lead of Diamond Queen might just suit *A*.

9. It is *Z*'s game to put the lead into *A*'s hand.

13. *A*–*B* make only three by cards, instead of five as in the actual game.

WHIST OR BUMBLEPUPPY.*

We are rejoiced to see a new edition of this capital little book, sparkling with fun and replete with sound whist sense. Some readers who complain that they cannot see where the whist ends and the fun begins may be comforted by learning that the whist ends on the last page, while the fun begins on the title-page. Such readers should parse carefully good Colonel Newcome's "emollunt" and "sinuisse," especially the last. It will do them good. We are pained to find that "Pembridge" does not recognise the real reading of two oft-misquoted lines of Shakespeare. The Bard of Avon must, of course, have written:—

> "Twigs in the trees; stones in the running brooks;
> Sermons in books: something in everything."

This is sound sense.

THE FACE OF THE SKY FOR APRIL.

By F.R.A.S.

THE sun is as destitute as ever of interest as a telescopic object, spots being small and occurring at rarer intervals. The zodiacal light may still be detected after sunset at the beginning of the month. The night sky is shown on map iv. of "The Stars in their Seasons." Minima of Algol occur at 11h. 56m. P.M. on the 14th, and at 8h. 45m on the 17th; as also at other times inconvenient for the observer. Mercury is a morning star throughout the whole month, and is not very well placed for observation. He may be detected with the naked eye in the east just before sunrise towards the end of the month. Venus is an evening star, and is a splendid object in the W. by N. after dusk. In her passage through the sky this month, she will pass between the Hyades and the Pleiades ("The Stars in their Seasons," map i.). Mars is quite invisible. Jupiter may be seen all night long. He is in opposition to the sun on the 21st; but unfortunately his south declination precludes the very finest definition of the details on his surface in the telescope. He will be found to the south of κ Virginis ("The Stars in their Seasons," map v.). The phenomena of his satellites, visible before 1h. A.M., are now becoming decidedly more numerous. On April 3rd, satellite II. will disappear in eclipse at 10h. 54m. 12s. P.M. On April 5th, the egress of the same satellite from the face of the planet will happen at 9h. 10m. P.M. Then at 11h. 33m. 43s. satellite I. will be eclipsed. On the 6th, the transit of satellite I. will begin at 9h. 2m. P.M. Its shadow, preceding it, will leave Jupiter's opposite limb at 10h. 53m., the satellite itself passing off at 11h. 13m. On the 8th, satellite III. will disappear in eclipse at 8h. 54m. 32s., to reappear from occultation at 11h. 41m. On the 12th, satellite II. will enter on to Jupiter's face at 8h. 54m. P.M. Its shadow will leave the opposite limb at 11h. 2m., and the satellite casting it at 11h. 24m. On the 13th, the ingress of the shadow of satellite I. begins at 10h. 35m. P.M., and that of the satellite itself at 10h. 46m. The shadow leaves Jupiter's opposite limb at 12h. 47m., and the satellite at 12h. 57m. On the 14th, satellite I. will be occulted at 10h. 15m. P.M. On the 15th, satellite III. will be eclipsed at 12h. 52m. 39s. P.M. On the 19th, the shadow of satellite II. will begin its transit at 11 o'clock, as will the satellite itself 6 minutes later. On the 20th, the shadow of satellite I. enters on the planet's limb at 12h. 29m. P.M., and satellite I. follows it one minute later. On the 21st, satellite I. will be occulted at 9h. 17m. P.M., to reappear from eclipse at 11h. 57m. 4s. On the 22nd, the satellite I. will leave the disc of the planet at 9h. 8m. P.M., as will its shadow at 9h. 10m. On the 26th, the shadow of satellite III. will pass off Jupiter's face at 8h. 31m. P.M. On the 28th, satellite II. will reappear from eclipse at 10h. 32m. 16s. P.M., and satellite I. be occulted at 11h. 30m. On the 29th, the ingress of satellite I. will occur at 8 40 P.M., and that of its shadow at 8h. 52m. The satellite will quit Jupiter's opposite limb at 10h. 52m.; its shadow at 11h. 5m. Lastly, on the 30th, satellite I. will reappear from eclipse at 8h. 19m. 19s. P.M. Saturn is still an evening star, but is now approaching the west. He travels during April from a point to the NE. of ζ Geminorum towards δ ("The Stars in their Seasons," map ii.). By the end of the month he will be quite close to δ Geminorum. Uranus will be found between 2° and 3° to the south of γ Virginis ("The Stars in their Seasons," map v.). The Moon enters her first quarter at 1h. 52·8m. P.M. on the 1st, is full at 5h. 38·9m. A.M. on the 7th, enters her last quarter at 4h. 3·8m. A.M. on the 15th, and is new at 8h. 53·2m. A.M. on the 23rd. She will enter her first quarter—for the second time this month—at 11h. 0·4m. P.M. on the 30th. High tides may be expected about the 7th. Occultations of stars by the Moon at convenient hours during the present month are fairly numerous, but in each case the star is a small one. Beginning with the 2nd, B.A.C. 2731, a star of the 6½th magnitude will disappear at the Moon's dark limb at 9h. 20m. P.M. at an angle of 111° from her vertex. It will reappear at her bright limb at 10h. 30m. P.M. at an angle from her vertex of 288°. On the 7th, 46 Virginis, a 6th mag. star, will disappear at her bright limb at 9h. 23m. P.M. at an angle from her vertex of 351°. It will reappear at her dark limb at 10h. 6m. P.M. at a vertical angle of 275°. At 10h. 59m. on the same night another 6th mag. star, 48 Virginis, will disappear at the bright limb at an angle of 28° from the vertex of the Moon. Its reappearance at 12h. 2m. at the dark limb occurs at a vertical angle of 271°. When the Moon rises on the 9th, she will already have occulted ξ^1 Libræ, a 6th mag. star. It will reappear at her dark limb at 8h. 38m. P.M., at an angle of 173° from her vertex. On the 25th, 48 Tauri, a star of the 6th magnitude, will disappear at the dark limb at 9h. P.M., at an angle of 85° from the vertex of the Moon. The Moon will have set ere it reappears. On the 29th, 3 Cancri, a 6th-magnitude star, will disappear at the dark limb 13 minutes after midnight, at a vertical angle of 199°, but the Moon will be setting when it reappears. On the 30th, 54 Cancri, of the 6½th magnitude, will disappear at the dark limb at 9h. 36m. P.M., at an angle of 74° from the lunar vertex. Its reappearance at the bright limb happens at 10h. 27m., at an angle from the vertex of 330°. Lastly, on the same night, at 12h. 25m., o^1 Cancri, a 6th-magnitude star, will disappear at the Moon's dark limb, at an angle of 172° from her vertex, reappearing 53 minutes after midnight at her bright limb, at a vertical angle of 236°. When these notes begin the Moon is in Gemini ("The Seasons Pictured," plate xxiv.), but she leaves this for Cancer at 4 P.M. on the 2nd. She quits Cancer in turn for Leo at midnight on the 3rd. Her passage through Leo occupies her until 1 P.M. on the 6th, at which hour she crosses into Virgo ("The Seasons Pictured," plate xxv.). She does not leave Virgo until 8h. 30m. A.M. on the 10th, when she enters Libra ("The Seasons Pictured," plate xxvi.). In her passage across Libra, she arrives at 1 A.M. on the 11th on the boundary of the narrow northern spike of Scorpio. By 10 o'clock the same morning she has traversed this, and passed into Ophiuchus. Her passage through the southern part of this constellation is completed at 2h. 30m. A.M. on the 13th, when she crosses its confines into Sagittarius. At noon on the 15th, she quits Sagittarius for Capricornus ("The Seasons Pictured," plate xxi.). Skirting the rather tortuous boundary between Capricornus and Aquarius, she does not fairly enter the last-named constellation until 4h. P.M. on the 17th. She is travelling across Aquarius until 8h. P.M. on the 19th, when she enters Pisces ("The Seasons Pictured," plate xxii.). Travelling through Pisces, she arrives at midnight on the 22nd at the dividing line of the northern prolongation of Cetus. She remains in this part of Cetus until 3h. P.M. on the 23rd, when she leaves it for Aries ("The Seasons Pictured," plate xxiii.). She only takes until 7h. 30m. P.M. on the 24th to cross Aries and enter Taurus. In her journey through Taurus she arrives at 4h. P.M. on the 27th on the boundary of the northern projection of Orion. When she has travelled through this by 4 o'clock the next morning, it is to emerge in Gemini ("The Seasons Pictured," plate xxiv.). She remains in Gemini until 10h. P.M. on the 29th, when she crosses into Cancer. She is still in Cancer at midnight on the 30th.

* "Whist or Bumblepuppy." By Pembridge. 3rd edition. G. E. Waters, and Simpkin, Marshall, & Co.

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THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

By Edward Clodd.

PART II.

CHAPTER V. - THE ORIGIN OF SPECIES (*continued*).

VI. *Natural selection tends to maintain the balance between living things and their surroundings. These surroundings change; therefore living things must adapt themselves thereto, or perish.*

IN treating of the obscurity which hangs around the ultimate causes of variation of living things, stress has been laid on the ceaseless and elusively complex interplay between them and the medium which surrounds, quickens, and nourishes them. As Gegenbaur remarks, the energies which cause changes in the organism either lie without the organism or for the most part are to be sought for without it.* An important distinction has to be made at the outset between plants and animals in the feebler response of the plant to its surroundings through the early secretion of cellulose which walls it in, and in its greater subjection to those surroundings by virtue of its fixed place. While the animal can wander, within certain limits, in search of food, the plant is compelled to take what comes to it, and, moreover, is powerless to escape the effects of altered temperature and climate. Hence its range of variation is limited compared to that of the animal. And however numerous the species of plants may be, the differences between them do not lie in the modes of nutrition, but in the modes of reproduction, whereas in animals, in addition to the variation in their modes of locomotion, we find them divided into three groups: 1, simple forms without body cavity; 2, higher forms with body cavity; 3, highest forms with digestive cavity separate from body cavity. But for this early "parting of the ways" life would probably have remained vegetal.

That the *touch* of the medium was the first quickener of variation is shown in the rise of the earliest approach to unlikeness at the surface, as in the membranous film which envelopes the lowest life-forms, and, among the higher animals, in the gradual specialisation of lines of communication—the nervous system and sense organs—with the outer world from infoldings of the skin. The diffused sensitiveness to smell, light, and sound became localised, the sense of touch remaining general over the body-surface, except where horny skin is secreted. Obviously, therefore, the tendency to vary which inheres in living things being stimulated by interaction between them and their surroundings, the degree in which variations are useful to living things—*i.e.*, in enabling them to win in the universal struggle for food and place—determines, under the action of natural selection, their survival.

The slow but ceaseless changes in things without have involved adaptive changes in all organisms except the lowest. Seemingly, all things remain as they were from the beginning. The range of our experience is too narrow, the time since scientific observation of nature began is comparatively so recent, the changes in living things so beyond direct detection, that we cannot wonder at people's reluctance to accept the theory that the countless species of plants and animals which have succeeded one another have a common descent, through infinite modification, from structureless germs. And, in fact, not only is life vastly older than any record of it, but the fossil-yielding rocks supply no key to the origin of the leading groups, whose representative types of to-day are so little altered that every fossil as yet found can be put into existing classes. Huxley remarks that "the whole lapse of geological time has thus far yielded not a single new ordinal type of vegetable structure," and although "the positive change in passing from the recent to the ancient animal world is greater, it is still singularly small."* The variation in ordinal type of animal structure is only about ten per cent. of the whole.

Yet we know that nothing is rigid; the earth records the gradual ascent of life-forms in structure and the changes in its crust, in a scripture that cannot be broken. The agencies within, and the far more potent agencies without, that have wrought those changes, pursue without pause their slow and sometimes sudden working. The great globe itself, on which a mere fraction of the sun's energy suffices to sustain life, speeds through space; careens and brings the seasons in their sureness; spins and gives, unfailing, the glory of sunrises and sunsets; and, in periodic changes of its orbit, crowns at one epoch its poles with vines and oaks and water-lilies, and at another epoch covers them with impassable snow.

Changes of climate and level, with the alterations in soil which they bring about, profoundly affect food and the power to obtain it. And the necessity for food being a strong—perhaps the strongest—stimulus to motion, the organism which the more readily adapts itself to the changed conditions, or is better equipped to resist them, wins in the struggle. The new functions to be discharged involve changes in structure, because the organs exist for the work which they have to do, not the work for the organs. Moreover, changes which arise in the structure are not limited to one part, the whole organisation being, in Darwin's words, "so tied together during its growth and development that when slight variations in any one part occur, and are accumulated through natural selection, other parts become modified." Take, for example, the growth of the deer's antlers, which in some species attain a weight of seventy pounds in a few weeks. The increased supply of blood which this involves necessitates readjustment of circulation, and the increased weight which the skull has to bear necessitates more powerful muscles and ligaments, with increased strength of the bones to which they are attached. More food is needed to supply the energy thus expended, involving more active digestion, and therefore modification of the digestive organs.

So far as the individual is concerned, there are the changes wrought in it by use and disuse—in the one case leading to the development of organs, in the other case to their decline. "Thus I find," Darwin remarks, "in the domestic duck that the bones of the wing weigh less and the bones of the leg

* "Comparative Anatomy," p. 57 (Eng. ed.).

* "Lay Sermons," p. 216.

more in proportion to the whole skeleton than do the same bones in the wild duck, and this change may be safely attributed to the domestic duck flying much less and walking much more than its wild parents.* But changes which are induced in organs by their use or disuse on the part of the animal are not transmitted; they die with the individual in which they occur. They are powerless to affect the type. It is to natural selection that we must refer modifications which, appearing as relics of structure common to large groups, have a specious look of being due to individual use or disuse. Take, for example, the whale as an illustration of this. The epitome of its ancestry which the embryo presents reveals its descent from land mammals having short fore and hind limbs, scanty covering of hair, broad beaver-like tails, teeth of different shape, and well-developed sense organs, especially of smell. These forefathers of the whale probably lived in marshy districts, and, being omnivorous, sought their food in both swamp and shallow water. As conditions more and more adverse to life on land supervened, they were gradually modified under the action of natural selection into dolphin-like creatures, living in fresh water, and at last, finding their way into the ocean, from which the huge sea-lizards of earlier epochs had disappeared, leaving these leviathans scope "to play therein." Hence are explained the adaptive changes of structure: the fore-limbs were modified into flippers enclosed in a fin-like sac, but retaining the bones corresponding to like structures in other mammals, as in the arm of man, the wing of the bat, and the fore-leg of the horse; whilst of the hind legs traces may be detected in a few species; the tail, which acted as a powerful swimming organ, became divided into two lobes; the head became fish-like in shape; the seven bones of the neck common to most mammals grew together; the skin became hairless; and the teeth, which appear in the young whale but are never cut, gave place to hanging fringes of whalebone, in the meshes of which the animal entangles the minute organisms upon which it feeds. In the seal, which is the modified descendant of land flesh-feeders, the hind legs have been developed, while the tail remains rudimentary.

Of course the existing species of whales and seals are the slowly modified descendants of only a small percentage of ancestors, who, in virtue of their favourable adaptations to altered conditions of life, survived under the operation of natural selection, by which also the majority, being unfit or less adapted, were weeded out.

Natural selection, therefore, is not causal, but directive. It is powerless to bring about the slightest variation in plant or animal; it is all-powerful to preserve variations "beneficial to the being under its conditions of life . . . it can do nothing until favourable individual differences or variations occur, and until a place in the natural polity of the country can be better filled by some modification of some one or more of its inhabitants."† Moreover, since it tends to establish balance between life and its surroundings, it does not imply all round development of the higher from the lower. Its key-note is adaptation. To quote Herbert Spencer's remarks on the erroneous conception of Evolution as implying that everything has an *intrinsic* tendency to become something higher: "if in the case of the living aggregates forming a species the environing actions remain constant from generation to generation, the species remains constant. If those actions change, the species changes until it is in adjustment with them. But it by no means follows that this change in the species constitutes a step in evolution. Usually neither advance nor recession results; and often, certain previously-acquired structures being rendered superfluous, there results a simpler form. Only now and then does the environing change initiate in the organism a new complication, and so produce a somewhat higher type."*

The sea-squirts and, perhaps, the marvellous rotifers, are examples of recession; actual degradation is probably limited to parasites; while in the unaltered condition of the simplest forms since the appearance of their earliest known representatives, we have examples of persistence of type. Their simplicity has been their salvation. A high organisation brings with it many disadvantages, for the more complex the structure the more liable is it to get out of gear. Unfortunately we cannot have highly convoluted brains, and digestive organs simple and renewable as those of the sea-cucumber, so that to the highest life-forms evolution is not all gain.

Variety of readjustment to altered conditions, resulting in progress in some directions and in stagnation in other directions, is evidenced in existing modifications of the common mammalian type. We find one group—plant-feeders—developing organs suited to their functions, as teeth for grinding and large stomachs, and also acquiring organs of defence or escape. In the flesh-feeders we find economy of bulk, great muscular strength, and, as compared with plant-feeders, prominent development of organs of attack. In both groups we find progression of parts which in the group including man are well nigh stationary. Among the Primates limbs, teeth, and organs of digestion, have all been slightly modified, and no organs of defence and attack developed. The explanation is that the animals, being unable to compete with the larger mammals, took to an arboreal life, which induced few variations of bodily structure, the most important being an opposable thumb and great toe for grasping. But the need for alertness against foes sharpened their wits, and the need of combination quickened the social instincts, so that the energy which in the flesh-feeders and the plant-feeders was stored in limb and muscle, was diverted in the Primates to development of brain. They thus escaped the limitations of one condition, which determined the development of lions and rhinoceroses in a given direction, and they preserved the power to adapt themselves to very diverse conditions. As shown by his career since the earliest times that we have record of him, this was markedly the case with the apelike ancestors of man. For his difference from existing apes is not in bodily form; the impassable chasm between him and them lies in the superior intelligence which he possesses in virtue of his more complex thinking apparatus. The arrangement of the furrows of his brain is much the same as theirs, but the convolutions are deeper the higher we ascend the scale, the gap between the civilised man and the savage being greater than that between the savage and the man-like apes.

Of the propositions expounded in the present and foregoing chapters this is the sum:—No two living things are exactly alike. Their inherent tendency to vary is excited by their surroundings, on which all life depends, and to changes in which they must adapt themselves or perish. Every living thing transmits its qualities, and therefore its variations, to its offspring; the more useful the variation the better is the plant or animal equipped in the struggle for life. For as all living things tend to multiply so rapidly that the earth would be too small in a very short time for a single species, a fierce and ceaseless struggle is waged, chiefly between the same species, for food and place. The result is that by far the larger number never reach maturity,

* "Origin of Species," p. 8.

† "Origin of Species," pp. 63 and 137.

* "Principles of Sociology," p. 107.

or are killed and eaten. In the long result variations give rise to new species.

The only assumption at the base of Darwin's theory is that sufficient time has elapsed since the beginning of life for the development of all past and present species of plants and animals from a common ancestry. As to the age of the earth, more especially as a fit and possible abode of life, geologists and physicists are not agreed. The geological estimate rests chiefly upon the rates at which the deposit of sediment, or the wearing away of soil by rain and rivers, are going on; but that estimate is based upon the assumption that present changes are the measure of past changes, whereas uniform action does not exclude the possibility of great and sudden revolutions. But, on the whole, the argument from geological evidence is strongly in favour of the lapse of not much less than one hundred million years since the earliest life-forms appeared and the oldest stratified rocks began to be laid down. This is much longer than the physicists, reasoning from the origin and age of the sun's heat, the rate of the earth's cooling, and other data, are willing to allow. But, however the question may be finally settled, the result cannot affect the evidence in support of the theory of descent which is supplied by the facts—1, of Embryology, or likeness of beginnings; 2, of Morphology, or likeness of structure; 3, of Classification of plants and animals; and 4, of their Distribution both in space and time.

WILD YOUTH'S TAX ON LIFE.*

By Henry Ward Beecher.

OLD age has the foundation of its joy or its sorrow laid in youth. Every stone laid in the foundation takes hold of every stone in the wall up to the very eaves of the building; and every deed, right or wrong, that transpires in youth reaches forward, and has a relation to all the afterpart of man's life. A man's life is not like the contiguous cells in a bee's honeycomb: it is more like the separate parts of a plant which unfolds out of itself, every part bearing relation to all that antecede. That which one does in youth is the root, and all the afterparts, middle age and old age, are the branches and the fruits, whose character the root will determine.

Every man belongs to an economy in which he has a right to calculate, or his friends for him, on eighty years as a fair term of life. His body is placed in a world adapted to nourish and protect it. Nature is congenial. There are elements enough of mischief in it if a man pleases to find them out. A man can wear his body out as quickly as he pleases, destroy it if he will, but, after all, the great laws of nature are nourishing laws, and, comprehensively regarded, nature is the universal nurse, the universal physician of our race, guarding us against evil, warning us of it by incipient pains, setting up signals of danger, not outwardly, but inwardly, and cautioning us by sorrows and by pains for our benefit. Every immoderate draft which is made by the appetites and passions is so much sent forward to be cashed in old age. We may sin at one end, but God takes it off at the other. Every man has stored up for him some eighty years, if he knows how to keep them, and those eighty years, like a bank of deposit, are full of treasures; but youth, through ignorance or through immoderate passions, is wont continually to draw cheques on old age. Men do not suppose that they are doing it, although told that the wicked shall not live out half their days.

Men are accustomed to look upon the excesses of youth as something that belongs to that time. They say that of course the young, like colts unbridled, will disport themselves. There is no harm in colts disporting themselves, but a colt never gets drunk. I do not object to any amount of gaiety or vivacity that lies within the bounds of reason or of health; but I do reject and abhor, as worthy to be stigmatised as dishonourable and unmanly, every such course in youth as takes away strength, vigour, and purity from old age. I do not believe that any man should take the candle of his old age and light it by the vices of his youth. Every man that transcends nature's laws in youth is taking beforehand those treasures that are stored up for his old age; he is taking the food that should have been his sustenance in old age, and exhausting it in riotous living in his youth. Mere gaiety and exhilaration are wholesome: they violate no law, moral or physical.

I do not object to mirth or gaiety, but I do object to any man's making an animal of himself by living for the gratification of his own animal passions. People frequently think that to require in the conduct of youth that which we expect in later life has something of Puritanism in it. Men have an impression that youth is very much like wine—crude and insipid until it has fermented, but when it has fermented, and thrown down the lees, and the scum has been drawn off, the great body between is sound and wholesome and beautiful. I am not one that thinks so. I think that youth is the beginning of the plant life, and that every wart or excrescence is so much enfeeblement of its fruit-bearing power. I do not believe that any man is the better for having learned the whole career of drunkenness or of lust, or the dallyings or indulgences that belong to a morbid life. A young man who has gone through these things may be saved at last, but in after life he has not the sensibility nor the purity nor the moral stamina that he ought to have. He has gone through an experience but for which his manhood would have been stronger and nobler. I thoroughly disbelieve that a man is any better for having in his youth passed through an experience that developed his animal nature and his lustful appetites. Excess in youth, in regard to animal indulgence, is bankruptcy in old age.

For this reason I deprecate late hours, irregular hours, or irregular sleep. People ask me frequently, "Do you think there is any harm in dancing?" No, I do not. There is much good in it. "Do you, then, object to dancing parties?" No; in themselves I do not. But where unknit youth, unripe muscle, unsettled and unhardened nerves are put through an excess of excitement, treated with stimulants, fed irregularly and with unwholesome food, surrounded with gaiety which is excessive and which is protracted through hours when they should be asleep, I object, not because of the dancing, but because of the dissipation. It is taking the time that unquestionably was intended for sleep, and spending it in the highest state of exhilaration and excitement. The harm is not in the dancing itself: for if they danced as do the peasants, in the open air, upon the grass under the trees, and in the day, it might be commended, not as virtuous, but still belonging to those negative things that may be beautiful. But the wassail in the night, the wastefulness—I will not say of precarious hours, for hours are not half so precarious as nerves are—the dissipation, continued night after night and week after week through the whole season, it is this I deprecate as eating out the very life. I am not superstitious of observances, but I am always thankful that there are forty days of Lent in the year when folks can rest from their debauches and dissipations; when no round of excessive excitement in the

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* This article was written by Beecher only a fortnight before his death. It was probably his last contribution to periodical literature.

pursuit of pleasure is permitted to come in and ruin the health and cripple the natural powers of the young.

The appetites of youth, which either in social or in solitary life drain down the vitality and impair the constitution, are so many insidious assaults on old age. I would that the young knew how clearly these things are written. God's handwriting is very plain and very legible to those who have eyes to see. There is not an intelligent physician that does not read, as he walks through the street, the secret history of the lives of those whom he meets, and that, too, without following them in their midnight career. I care not to have men come to me and state their secret courses; I can read it in the skin and in the eye. There is not one single appetite of passion that has not its natural language, and every undue indulgence of that appetite or passion leaves that natural language more or less stamped upon the skin, upon the features, upon the expression of the face, or the carriage of the body. There is always some token that tells what men are doing, if they are doing anything to excess. Pride has its natural language; mirthfulness has; goodness has. Nobody doubts this. So have the passions their natural language. Men think that if they commit their wickedness in secret places, or in the night, that it is not known. It is known, although no man may ever say to them: "Thou art guilty!"

The use of stimulants in youth is another detraction from happiness in old age. Men usually take what they least need. In other words, we follow our strongest faculties, and not our weaker ones; and therefore if men are excessively nervous they almost invariably seek to make themselves more so.

I rejoice to say that I was brought up from my youth to abstain from tobacco. It is unhealthy; it is filthy from beginning to end. In rare cases, where there is already some unhealthy or morbid tendency in the system, it is possible that it may be used with some benefit; but ordinarily it is unhealthy. I believe that the day will come when a young man will be proud of not being addicted to the use of stimulants of any kind. I believe the day will come when not to drink, not to use tobacco, not to waste one's strength in the secret indulgence of passion, but to be true to one's nature, true to God's law, to be sound, robust, cheerful, and to be conscious that these elements of strength and health are derived from the reverent obedience of the commandments of God, will be a matter of ambition and endeavour among men.

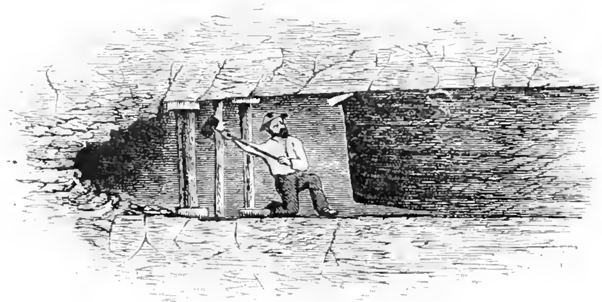
COAL.

By W. Mattieu Williams.

"LONG-WALL" working is more economical than the methods already described, as it leaves behind no supporting pillars of coal. To understand it, let us suppose that roads are driven in the coal from the pit to the boundary of the "royalty" or area to be worked, and that these lead to another road which crosses them and follows the boundary. In this case the coal has to be removed from the boundary towards the pit. Further, suppose that the roads from the pit are one hundred yards apart, and it is obvious that between each of these roads there is a face or wall of coal one hundred yards long. The problem is to cut away this wall on the side towards the pit, and carry all the coal into the pit roads without crushing the men as the unsupported roof comes down.

The illustration shows how this is done. It represents the face of the coal as seen in section from the end of one of these pit roads looking forward into the road that is parallel to the boundary. The man is kneeling in face of the wall of the coal to be removed, and working towards the pit. He has already undercut the seam, and is breaking it down, "holeing" it, by striking the wedge. Behind him are seen three props for supporting the roof at the part from which the coal has been removed, and behind these pillars is the *goaf* or *gob*, *i.e.*, the ruins of the crushed-in strata which always give way to the superincumbent pressure when any considerable area is left unsupported. When the cutter has brought down a few feet more of the face upon which he is now working, and the coal has been carried away, the hindmost row of props is knocked away, and brought forward to form a front row, the roof which they formerly supported now falling down.

It is commonly imagined that great cavities are left in the sites of worked-out coal-mines, and geological and even cosmical theories have been based on the assumption that



the shrinkage of the cooling earth will leave vast cavities beneath its crust, in which the ocean will finally be engulfed and leave the surface of the earth as arid as that of the moon. An examination of the goafs and creeps of coal workings would, I think, completely convert the most earnest advocates of these views. I have groped through many celebrated natural caverns, and find them to be nothing more than narrow tunnels with occasional enlargements, the widest of which cannot display an unsupported roof nearly equal in length and span to the Midland Railway Station at King's Cross.

Although such caverns are continuously in the course of formation and enlargement wherever surface water percolates limestone rocks, they usually crush in even before attaining the dimensions of the Albert Hall. The crushing in of the roof of the ten-yard seam in South Staffordshire is a continual source of minor artificial earthquakes.

Houses are split down the middle, and others toppled over; railways drop, and have to be continually relevelled. In the report of the Committee on Accidents in Coal Mines, 1849, we are told that "it is a matter of everyday occurrence for houses to fall down, or a row of buildings inhabited by numerous families to assume a very irregular outline, from what they call a *sway* caused by the sinking of the ground into old workings. It is often a serious matter to find a sound site for church or school building. . . . There is an instance in the parish of Sedgley of a church and parsonage house, recently erected, composed of wooden framework, which will admit of their being screwed up into the perpendicular again whenever they may be thrown out of it." Similar troubles on a serious scale are now occurring over the Cheshire salt mines. The newspapers of a week or two since report that in one of the main thoroughfares of Northwich "the foundation of a shop, together with about ten yards of the adjoining footpath, sank into a deep pit, which soon became filled with water," and that "a pit four yards in diameter and five yards deep was suddenly formed in the Hartford volunteer drill shed."

In some cases this crushing down of the superincumbent rock supersedes the work of wedging; the coal comes down when merely undercut. This of course increases the demand for props, and renders the working more dangerous. A great deal has been written about the limits of depth to which it is possible to carry coal working. Hull estimates it at about 4,000 feet, and this is pretty generally accepted on account of the high temperature that would be there reached. For reasons that I will discuss hereafter I believe that the temperature difficulty may be overcome, and that the limit of depth at which it is possible to mine for coal or any other mineral will be determined by the viscosity of the crust of the earth, by its flowing after the manner of liquids when subjected to a sufficient amount of pressure. I venture to predict that if ever the "trou Flammarion"—the great boring into the earth's interior—is carried out as projected, a limiting depth will be reached by the inflowing of the granitic rock.

Gunpowder blasting is used in some collieries instead of the wedge, but only where there is no firedamp. Even in the absence of such combustible gas, blasting may be dangerous. Mr. Galloway has proved, by an exhaustive course of observations and experiments, that in collieries where the workings are dry serious explosions may result from the firing of mere coal dust. A substitute for blasting has been proposed which appears promising, but I am not able to estimate its practical merits. This is to bore a hole as in blasting (which is very easily done in a soft material like coal), ram quicklime into this, and then allow water to percolate therein. Quicklime combines chemically with water, forming the hydrate of lime, and in doing so expands with great force.

Long-wall working may be carried out by commencing near the shaft and working away from it towards the boundary. In this case gob-roads have to be made in the goaf or fallen *débris*, and such roads must be supported artificially. Under this system a profitable return is obtained much sooner than when the working is begun at the boundary. All the time in cutting the roads is saved, and the first getting of coal is so near to the pit that the *putting*, or carriage underground, is reduced to a minimum at the commencement. If any of my readers are tempted to take shares in a successfully working colliery, and the temptation is backed by the display of a balance-sheet showing large profits, let him inquire into the mode of working, as he may be perfectly assured that, if this method of beginning near the pit is in operation, the cost of working will gradually increase with the increasing length of gob-roads that require expensive supporting, and the gradually increasing distance along which the coal must be dragged before reaching the pit. On the other hand, if the method of working I first described is in operation, that from the boundary pit-wards, these expenses will go on diminishing with every stage of progress towards the pit; besides which there must be roads ready made which represent a considerable amount of capital value.

It would be out of place here to go into further details concerning modifications of long work, or intermediate methods partaking of the character of long work and pillar-and-stall work combined. I may add that when I was in North Wales about twenty years ago the introduction of long-wall work met with considerable opposition among the Flintshire colliers. They supposed it to be more dangerous than the older methods. It probably was so at first, but now that it is better understood the majority of practical mining engineers and of underground stewards maintain that it is less dangerous, and this conclusion is confirmed by the statistics of colliery fatalities.

Among the good old books of reference demanding a new edition carried forward to date is the "Cyclopædia of Useful Arts," by Charles Tomlinson. In the article "Coal" therein are painful pictures representing some bygone horrors of colliery work. There is (page 396) "a hurrier in a Halifax coal pit," a girl in her teens harnessed like a beast, by means of girdle and chain called a *dog-belt*, to a lorry or coal truck, and dragging it like a beast on all fours through the dark, dripping tunnels of the pit. She is barefooted, bare-legged, and naked downwards to the hips. Another picture of "coal-bearing in the East Scotland mines" represents two girls carrying the coal in baskets on their backs up a ladder of villanous construction. Other pictures of women carrying coal on their backs along steep underground roads, and up a "turnpike stair" or screw platform, are too truthful representations of barbaric practices which are now totally abolished in Britain, though still lingering on in other conutries. Our legislation has justly prohibited the employment of girls and women in any capacity whatever underground, and the ruin which the blind worshippers of demand and supply predicted as a consequence of this interference has not befallen us, but on the contrary, it has enforced upon capitalists the adoption of other methods which have proved themselves, not only more humane, but actually more economical and profitable.

In the course of our current jubilations, many historical summaries of our progress during the last fifty years have been published; but I find little or nothing there stated concerning the general emancipation of women from degrading unfeminine occupations and excessive hours of toil. A special chapter might well be devoted to this feature of our social progress, as one especially worthy of attention, and proudly characteristic of the reign of Queen Victoria.

All pit roads are now railroads. Where the inclines are steep and straight, and in many cases where they are not steep, steam-power is used to haul the "tubs" or pit wagons to the shaft. The power is applied to a winding drum, which hauls a long rope to which a train of tubs is attached. Where the incline exceeds 1 in 30 the empty tubs are run down by gravitation, dragging out the rope from the drum as they descend. If the incline is insufficient, a tail rope is attached, and the empty tubs and hauling rope are drawn down by this.

In colliery working, as in everything else, conservative resistance to progress exists, and on this account, as well as from local difficulties, horse and even boy power is still used in drawing the tubs along the roads. Welsh and Shetland ponies are consequently in demand for pit work. I see by to-day's newspaper (April 9) that at Lord Londonderry's sale Shetland ponies "brought from sixteen to thirty guineas apiece." The writer adds that "many of the hapless little animals sold on Thursday are doubtless destined to pass the rest of their lives at the bottom of a black and hollow vault," and he refers to the alleged brutality of rough pitmen in the treatment of these animals, but is willing to believe that considerable improvement has recently taken place.

I quote this in order to correct the popular errors which it expresses. Colliers as a class are by no means rough and brutal, less so than average London wagon and cart drivers, and the condition of pit ponies is one that London cab or omnibus horses may justly envy. They are well fed, not overworked, commonly petted, and demonstrate the good treatment they receive by their condition. It is well known in colliery districts that ponies generally improve in condition and value by underground work. Given two ordinary

Welsh ponies of equal age and equal market value, take one down a coal pit to work in the ordinary manner for six months, and let the other work above ground for the same period. At the end of the time the pit pony will sell for 20 per cent. more than the other in any horse fair. The fine condition of the coat of pit horses is proverbial. It is partly due, no doubt, to the climate, which is always temperate, with a variation of only a few degrees. Such a climate is especially favourable to horses.

ANCIENT SOLAR FESTIVALS.*

By W. St. Chad Boscawen.

AMONG a star-gazing people like the ancient Chaldeans, the equinoxes became early observed, and of this testimony is furnished by inscriptions recording the dates of the equinoxes. These inscriptions come from the royal college library of Nineveh, and form part of the great collection of astronomical and astrological documents found there. In these documents, of which I quote the following example, the natural phenomena of the equinox are observed (W. A. I., iii. 51. 1):—"The sixth day of the month Nisan, the day and the night balanced. There were six *kaspu* of day, six *kaspu* of night." This report shows how from the temple observatories of Assyria in the reign of Assurbanipal (B.C. 664), the equality of day and night has been noted, each consisting of six periods or *kaspu*, each of two hours' duration. These periods of diurnal measurement were each again subdivided into three periods or watches of two hours each, and each astronomical occurrence was carefully noted as to the period in which it occurred. But the fact that the periods of the equinoxes and the solstices were made the time of great religious festivals was first made clear by the discovery of a calendar of the Babylonian year, which is now supplemented by the valuable tablet recording the solar festivals discovered by Mr. Rassam amid the ruins of the ancient city of Sippara of the Sun, the Chaldean Heliopolis. This tablet, dated on the twentieth day of the month Nisan, in the thirty-first year of Nabubaliddina, king of Babylon, records the four great solar festivals of that year which were honoured by donations from the great king. The first point to be ascertained is the date of this document before the Christian era, and this we can approximately arrive at from his reign being synchronous with those of two of the important monarchs of the middle Assyrian empire. He appears first in the records of Assyria in B.C. 879, and he concluded a treaty of peace with Shalmaneser II., which lasted until B.C. 853, when his son succeeded him as ruler. Upon these facts we may place the date of this important record as from B.C. 853 to B.C. 860. The dates of the equinoxial festivals given in this record are as follows:—

On the seventh day of Nisan. This was the feast of the new year, and corresponded to the Jewish Passover. Corresponding to this feast of the vernal equinox there was in Tisri or Tasrituv, the seventh month, on the seventh day, the feast of the autumnal equinox. We know from the astronomical tablets that the four points on the great circle marked by the equinoxial and solsticial periods were called the positions of the *nibiru*, or "crossings," or "passings over." In the Creation tablets these points are said to have been specially fixed by the god Bel or Belus, whom both the inscriptions and Berosus agree in making the ruler of the astronomical bodies, times, and seasons. The above tablet now reveals to us the very important fact of the existence and observation of a second pair of older equinoxial festivals. On the tenth day of Airu or Iyar, the second month, and on the fourteenth day of Marchesvan, the eighth month, are a second pair of corresponding festivals, which from their positions on the great circle are evidently old equinoxial festivals, which by the precession of the equinoxes had given place to a new pair of festivals.

In the time of Hipparchus, and as far back as B.C. 2540, the vernal equinox had fallen in the constellation Aries, and in the astronomical inscriptions copied from the library of Sargon of Aganne, a monarch who reigned prior to the Median or Cassile dynasty in the nineteenth century B.C., the vernal equinox was in Nisan and in Aries. But it is evident from this inscription that there was a time in the annals of Babylonian astronomy when the vernal and autumnal equinoxes fell in Taurus and Scorpio. The foundation of Babylonian astronomy dates back to the period of poliarchy, the period prior to the rise of the Median dynasty; and although we cannot accept the prodigious antiquity which Berosus and other Greek writers assign to it, the remote period of its existence is clearly evident. The compilation of the great astronomical work, consisting of seventy tablets or books, entitled "Namar Beli, the Illumination of Bel," an edition of which has been found in the royal library at Nineveh, was a work carried out by order of Sargon I., King of Aganne, a monarch whose rule was prior to the Median conquest. As regards this work there is much internal evidence that it was prepared by the Kusho-Semitic people, not by the Tartar Akkadians. With the former the nightly observation of the stars during their nomadic wanderings had led to the development of a certain amount of natural science regarding the celestial phenomena. In the pages of the great Babylonian astronomical work there are afforded many interesting glimpses of the popular life and thoughts. The stars are entitled "the sheep," and an important star, which I am inclined to regard as the pole star of the period, bore the name of the star "Sib-zi-AN-NA," "the shepherd of the heavenly flock"; while the morning and evening stars* bore such poetic titles as Lulim, "the leaders," or, as an inscription shows the word in pastoral phraseology to mean, "the bell wether," or "leader of the flock." In the omens deduced from celestial appearances we find such as affect the life of the nomad, "Rain in heaven, floods in the channels," reminding us of the favourite Arab expression, "The stars have brought rain," "Cattle are safe in the pastures," "The enemy sweeps all away." Such phrases as these, written three or four thousand years ago, have still a close agreement with modern Bedouin Arab life. The Akkadian element which appears in the astronomy and astrology of the Babylonians is most apparent in the abstruse mathematical calculations and theories of star-influences on the life, which result from the Fetish or Animist creed of the Tartar Akkadians, and in which, when the tablets have been thoroughly examined, I expect that we shall find the basis of the Cabbalistic

* This interesting essay was sent us several years ago, and marked for early insertion, but was mislaid in a volume of star maps which had been used in examining some of its astronomical statements. It curiously confirms many of the ideas to which I have been led in drawing up my essays on "The Unknowable." I have recently obtained other evidence about the stars as interpreted in ancient times which will be found, I think, to render Mr. Boscawen's subject especially interesting.—Ed.

* I should be disposed to doubt this interpretation—that is, if the words "morning and evening stars" signify, as usual, Venus. Might not the stars heliacally rising and setting be understood?

theories of the Jews. At the time when the great astronomical work of the Chaldeans was compiled, and when the calendar was fixed, which we must, as far as evidence goes, place about B.C. 2000–2500, the bright star Thuban in the constellation Draco was near to the pole. Placed as this star Thuban, α Draconis, is, it seems to me to be very possibly the star called "the star of the tip of the tail."* This star was especially the omen of weather changes. We read, "The star of the tip of the tail a great cloud obscures. Locusts in the land are," or "The star of the tip of the tail at its rising, the waves of the sea rise at the beginning of the month Tammuz." The connection of this constellation and its bright star with storms, tempest, and sea, certainly seem to connect it with the storm-dragon, the demon who figures so often in Chaldean mythology, and may, as you have so truly pointed out, be a relic of astro-mythology. The occurrence of these equinoxial festivals on the newly-discovered inscription from Sippara serves to show that we must place the rise and, to a certain extent, scientific development of Babylonian astronomy further back in the past than we have hitherto expected. The very remarkable find of a complete library of tablets in the priests' quarters of one of the oldest Babylonian temples, which has resulted from recent explorations, may no doubt throw further and more clear light upon some of the obscure points in the astronomy of the ancient Chaldeans. Should any such be found, I shall be glad to place them before the readers of Knowledge, who will no doubt estimate their scientific value better than I am able to do.

SOLUTIONS OF PUZZLES.

I. BUILDING A TRIANGULAR PYRAMID.

PROBLEM XXV. (see last Number). To arrange equal regular tetrahedrons and octahedrons, with equal triangular faces, into a single tetrahedron (or regular triangular pyramid) set six of the tetrahedrons on the base ABC, as shown in fig. 1, where a, b, c, d, e, f, represent the apices of six tetrahedrons standing on the bases ADF, DFG, FGK, EBH, GHL, and KLC.

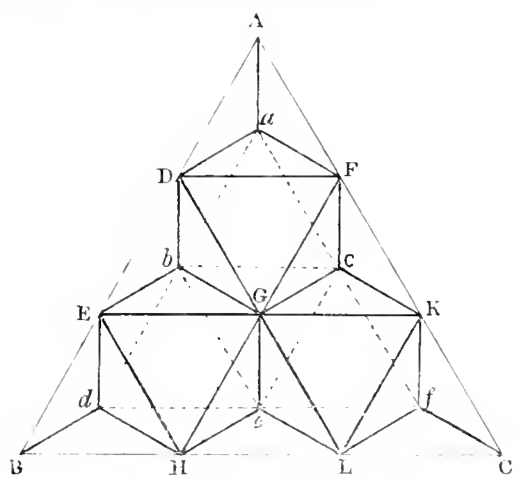


Fig. 1.

It is then seen that three octahedrons will fit into the spaces DaFGb, EbGeHd, and GCKfLe, their upper triangular faces (regarding ABC as the *base* of the pyramid we are building up) being, respectively, abc, bde, and cef. Now insert a seventh tetrahedron into the space bce, with an angle downwards at G. We have then the triangular surface adf. We now set a tetrahedron on each of the triangles abc, bde, and cef; fit in a tetrahedron between them: on whose triangular upper face we set a tetrahedron, and the regular tetrahedron or triangular pyramid with equilateral faces on the equilateral base ABC is complete.

[The outlines of the tetrahedrons and octahedrons above the lowest layer are not shown, but the reader will have no difficulty in seeing how the upper layers forming a pyramid on the base adf are formed. He may regard the part AEK of the figure as showing this, for it shows three tetrahedrons, ADF, DEG, FGK, one octahedron DaFGb, and the base abc of the tetrahedron needed to complete the regular tetrahedron on the base AEK.]

Schol.—The numbers of octahedrons and tetrahedrons required to complete the successive layers of a built-up tetrahedron are as follows, going downwards:—

Layer.	No. of Tetrahedrons.	No. of Octahedrons.
1	1	0
2	$[1+2)$ or 3	1
3	$[1+1+2+3]$ or 7	$[1+2]$ or 3
4	$[1+2+1+2+3+4]$ or 13	$[1+2+3]$ or 6
&c.	. . . . .	. . . .
n	$\left[\frac{(n-2)(n-1}{2}+\frac{n(n+1)}{2}\right]$ or $n^2-n+1)$	$\frac{(n-1)n}{2}$

Hence the total numbers of tetrahedrons and octahedrons required to form a tetrahedron, each of whose edges is n times as long as an edge of the smaller solids, are as follows:—

Tetrahedrons

$$=\Sigma_n^1(n^2-n+1)=\frac{n}{6}(n+1)(2n+1)-\frac{n(n-1)}{2}=\frac{n}{3}(n^2+2)$$

Octahedrons

$$=\Sigma_n^1\left(\frac{n^2-n}{2}\right)=\frac{n}{12}(n+1)(2n+1)-\frac{n(n+1)}{4}=\frac{n}{6}(n^2-1)$$

Thus the ratio of the number of tetrahedrons to the number of octahedrons is

$$2n^2+4 : n^2-1;$$

and when n is very great this ratio becomes very nearly equal to 2 : 1.

We can now very readily see in what ways sliding is possible when space has been filled up with tetrahedrons and square-based pyramids, or with tetrahedrons and octahedrons, in the manner considered above, and in Puzzles XXII., XXIII., and XXIV., solved last month.

First, note that in the less interesting case first dealt with last month, where tetrahedrons and half octahedrons are used, we get layers which may be shifted as layers in directions parallel to their plane faces. Once shifted so that the triangular faces of pyramids and tetrahedrons no longer coincide, there is no shifting of strips; but when these faces are brought into coincidence, as in the building up of the four based pyramid, we see that longitudinal strips, formed of rows of pyramids with tetrahedrons fitted in between them, can be shifted in the direction of their length. There are four other ways of sliding layers with corresponding ways of sliding strips which will be recognised from the study of what follows.

Secondly, when space is built up of tetrahedrons and octahedrons, in the manner indicated above in the solution of Problem XXIII., as well as in that of the problem we have just dealt with (both methods giving precisely the same arrangement so far as the filling in of space is concerned), we have the following ways of sliding layers. In

* This, from what follows, seems impossible. For the "star of the tip of the tail" is described as "rising." The pole star does not rise.—Ed.

the method of building up, illustrated in fig. 1, we have a series of layers parallel to the triangular face ABC. But also manifestly we have a series parallel to those faces of the built-up pyramid which have AB, BC, and AC respectively as base. Hence there are four directions in which parallel layers can be slid. And clearly when the faces of tetrahedrons and octahedrons agree (after sliding layers in any of these four ways), we can slide strips such as the three AFHB *aced*, ADLC *abef*, BEKC *dbef*, in the directions of their length; while corresponding strips can be carried in other three directions for each of the three plane positions corresponding to the three other faces of the tetrahedron, having AB, BC, and CA, respectively, as base.

Thirdly, when space is built up of the solid, considered in the solution of Problem XXIV., no sliding or shifting is possible, without breach of continuity.

II.—PROBLEM OF THE HONEYCOMB CELL-ENDS.

[Why Puzzle XXVI. is thus called will be seen further on.]

PUZZLE XXVI. The reader will have noticed a slight error in the statement of this puzzle. The arrangement in the second box of oranges as described in the February number is not symmetrical like that of the oranges in a triangular pyramid. It differs in that the centres of any row of oranges are vertically over those of the row next but one above and below, whereas in the triangular pyramid of oranges the centre of an orange is vertically over the space between three oranges in the layer next but one below, as well as in the layer next below. It is this last arrangement we have to deal with, in which the oranges are set as in the first and third arrangement, so far as regards the set of oranges touching any given orange.

The only difficulty with this puzzle is in making the solution clear without occupying too much space or giving more time to the matter than it may seem to be worth, though the study of it affords excellent geometrical gymnastic.

Figs. 2 and 3 show two ways of viewing a globe symmetrically surrounded by twelve equal globes touching it and each other. The globes in the two figures are lettered

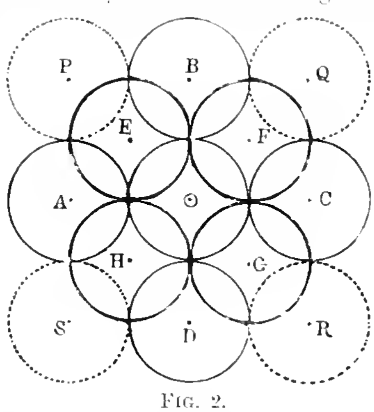


Fig. 2.

alike. In fig. 2 the four heavy circles are supposed to represent eight globes, four in the uppermost layer, four below these. The layer between contains five globes in the form of a cross, the middle one being the surrounded globe we are chiefly considering. The four dotted circles represent globes necessary in building up the group, but not among those which touch the middle globe. In fig. 3 the three dotted globes are the lowest layer, the lightly marked ones the middle layer, and the heavy ones the top layer. Small italic letters mark the centres of globes belonging to lower layers.

In fig. 4 the circle ABCD, and in fig. 5 the circle A*ef*CGH, are supposed to be orthogonal views of the surrounded globe, with the points where the several globes surrounding it touch its surface. Outline dots show points of contact seen through the globe. At E, F, G, and H (fig. 4) two points

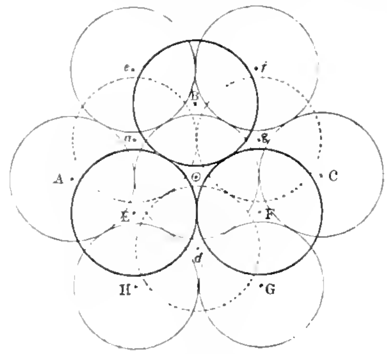


Fig. 3.

coincide; this is shown by circles outside dots. Fig. 2 accounts for the arrangement of the dots marking contact points in fig. 4, while fig. 3 accounts for that of the corresponding points in fig. 5. The reader who cannot after a little thought demonstrate this, and understand details, would not care to follow a verbal demonstration. But indeed the figures will explain and demonstrate by themselves the relations dealt with, for all readers of geometrical proclivities—and no others are likely to read these lines.

Now it is clear that, when the globes all simultaneously expand, the pressing surfaces will become plane, and those inclosing the expanded globe ABCD, figs. 4 and 5, will touch

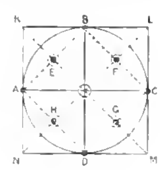


Fig. 4.

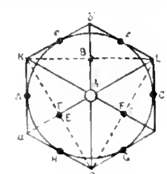


Fig. 5.

the sphere ABCD at the points of original contact with neighbouring globes.

This premised, we see that the planes touching the sphere ABCD at E, F, G, H (both above and below the plane ABCD) meet at a point in O, vertically above the centre of the sphere as seen, and have the apparent forms OAKB, OBLC, OCMD, and ODNA—which are squares—but being really rhombuses having shorter diameters AB, BC, CD, and DA in real length, and longer diameters OK, OL, OM, and ON in apparent length. These longer diameters are obviously slanted 45° to the line of sight (consider fig. 2, to see that this must be so), hence their real length will be AK$\sqrt{2}$. Calling the common radius of the original globes r, the longer and shorter diagonals of these rhombuses or diamonds will be respectively $\sqrt{2}r$ and $2r$. We perceive, further, that the plane-faces touching ABCD at A, B, C, and D, are foreshortened into the straight lines NK, KL, LM, and NM, which, regarded as straight lines, are diagonals of other rhombuses, and are each equal to $2r$.

Our solid figure has then eight rhombus faces, all equal, viz., the four supposed to be seen in fig. 4, and the four on the farther side, which, if visible, would have the same outlines in the orthogonal or perspective representation. The figure has four other rhombus faces whose shape has still to be determined. But we know already that each of these four other faces has a diameter equal to the longer diameter of the eight faces already determined.

Fig. 5 enables us to determine the other diameter. We see that the planes touching the sphere ABCD, fig. 5, in the points B, E, F, meet at a point in b vertically above the centre of the sphere, and have the apparent forms OaKb, KbLb, Lcob, while those on the farther side, if seen through the sphere, would have the forms aKb b, bb'Lc, and $abco$. Now obviously all these are equal rhombuses; so that as two of those on the upper side are rhombuses of a size and shape already determined, so also is the third KbLb'. But this can easily be independently demonstrated. For the diameter KL is obviously equal to AC or $2r$, while bb', which appears to be equal to $\frac{2r}{\sqrt{3}}$, is really seen at an angle equal to that between the perpendicular from an angle of a regular tetrahedron on an opposite face and an edge through that angle (consider fig. 3 to see that this must be so). Therefore bb' is really equal to $\frac{2r}{\sqrt{3}}$, increased in the proportion which an edge of a regular tetrahedron bears to such a perpendicular, or as 2 to $\sqrt{\frac{8}{3}}$. Hence the shorter diagonal of the rhombus bKb'L is really equal to $\frac{2r}{\sqrt{3}} \cdot 2\sqrt{\frac{3}{8}} = \sqrt{2}.r$, as before.

In fact, the semiregular solid formed by the expansion of the elastic surfaces of the equal globes is no other than the solid considered in the solution of Problem XXIV., in our last number.

The rhombuses shown in perspective in fig. 5 are identical in shape with those seen at the ends of the cells of the honeycomb, when these cells are regular.

III. THE ALPENSTOCK PUZZLE.

Puzzle XXVII. I must deal briefly with this, having already given more space than I intended to the solutions of these problems. (I would remark, however, that the study of all these problems will be found to afford excellent exercise in tridimensional geometry.)

The "ingenious beast" having explained his ideas *en route* to his two masculine fellow-travellers, they proceeded at once on their arrival at their resting-place to the following construction:—

Laying down the six sticks AB, DE, &c., in the position shown in fig. 6, LM, NO, and PQ lying upon the others, and

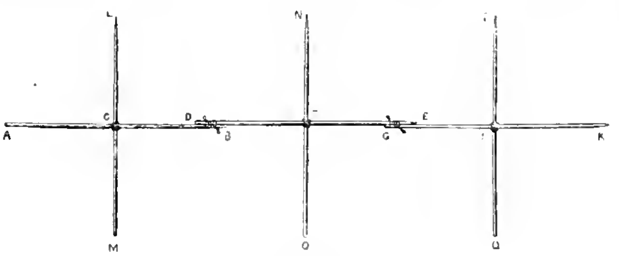


Fig. 6.

all crossing at their middle points, they tied them with stout cord at DB and GE, and at C, F, H. Then two of them brought K over to A, tying the sticks AB and GK together by the ends AK, while the third brought the ends L, N, M together and stoutly tied them. Thus they had the sticks in the form shown in fig. 7. Then they used the ropes which as careful mountaineers they used in travelling to "seat" the triangular spaces ACH, BCF, EFH. As an end of one of these ropes had already been used in fastening the ends N, P, L together, it was easy to carry the rest of this rope down under C, F, and H outside the slant alpenstocks, giving the lines CH, HF, and CF, which admit of being tautened to any necessary extent, by carrying the rope in the directions shown by the dotted lines within the triangle CHF. This makes the ropes within the seat-triangles taut and strong, while shawls or wraps thrown over these seats make them sufficiently comfortable for an *al fresco* meal. Anyone sitting alone at AK, DB, or EG, can tip the whole concern

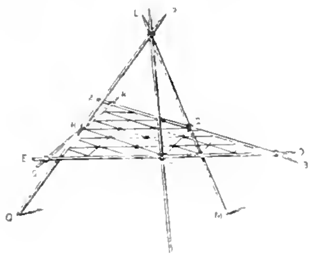


Fig. 7.

over; but the seats are not meant to be used in that way. But two people sitting even so absurdly as this—that is to say, one at AK, the other at EG—would not disturb the equilibrium of the seat. When two sit on each side of C, two on each side of F, and two on each side of H, all six are safe, assuming the alpenstocks sufficiently (and the six people not too) stout.

OUR PUZZLES

OR

MATHEMATICAL RECREATIONS FOR MAY.

PROBLEM XXVIII. *A mathematically disposed person is troubled by the circumstance that he sees himself in an ordinary mirror, not as his friends see him, but with his right side where they see his left, and* vice-versâ. *Also, it seems to him a nuisance that he has always to go in front of his mirror to see himself in it at all. He therefore divides his mirror into two parts, and so fits these that wherever he may be in his room (his eyes not being, however, above or below certain convenient limits of level), he can see himself in the mirror as newly adjusted, and always as his friends see him, not as one usually sees oneself in a mirror. How did he manage this?*

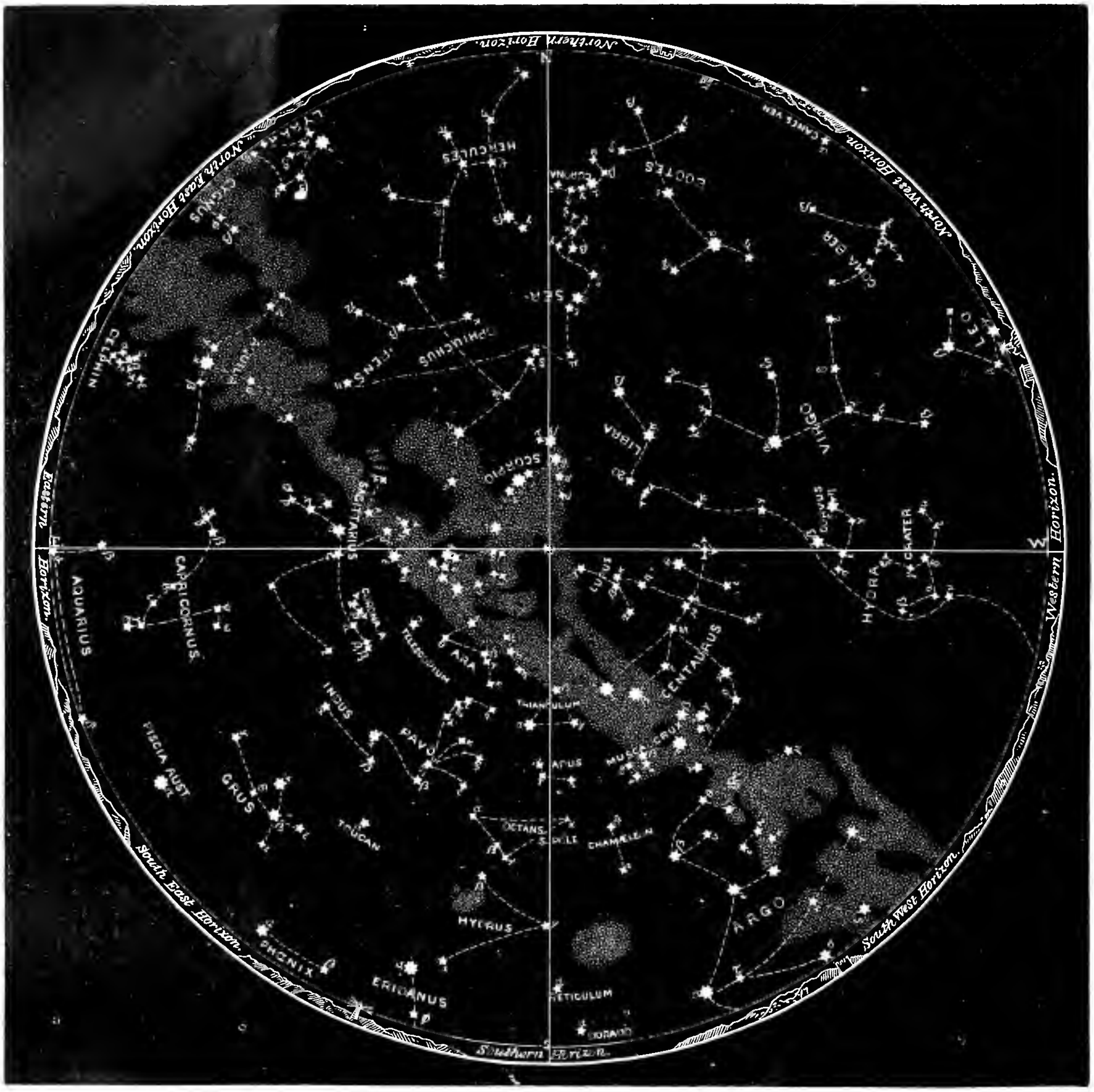
Problem XXIX. *Supposing the eight corners of a room lined with mirror glass, agreeing exactly with the plane surfaces of the walls, ceiling, and floor (the room having all its faces perfectly rectangular), what would one see on looking into any corner?*

Problem XXX. *Supposing the twelve edges of the same room lined with mirror glass, how many images of himself could any one within the room see, and in what positions and aspects?*

Curious Observations on the Growth of the Heart.—Dr. Benecke, of Marburg, has made known his curious observations on the growth of the human heart, the fact appearing that the increase is greatest and most rapid during the first and second years of life, its bulk at the end of the second year being exactly double what it originally was; between the second and seventh years it is again almost doubled. A slower rate of growth now sets in, until about the fifteenth year, the augmentation of volume during the intervening seven or eight years being only about two-thirds. In the period of maturity which now approaches the growth of the heart again makes progress, the increase keeping pace with the advance toward maturity of the other portions of the system. After the fifteenth year, up to the fiftieth, the annual growth is about ·061 of a cubic inch, the increase ceasing with the fiftieth year, a slight diminution then ensuing. Again, in childhood the male and female heart are alike; after maturity, the male heart develops more than the female, and the difference between the two that is thus established—one and a half to two cubic inches—is said to be maintained throughout the remainder of life.

THE SOUTHERN SKIES.

Map VII.—For April, May, and June.



The Night Skies in the Southern Hemisphere (Lat. 46° to 24° S.)
and the
Southern Skies in England (Upper Half of Map only) at the following Times:

At 1 o'clock, morning, May 7.	At 11 o'clock, night, June 7	At 9 o'clock, night, July 7.
,, 12.30 ,, ,, May 15.	,, 10.30 ,, ,, June 14.	,, 8.30 ,, ,, July 14.
,, Midnight, May 22.	,, 10 ,, ,, June 22.	,, 8 ,, ,, July 26.
,, 11.30 o'clock, night, May 30.	,, 9.30 ,, ,, June 30.	,, 7.30 ,, ,, Aug. 3.

Star Magnitudes

First . . . . Second . . . . Third . . . . Fourth . . . . Fifth . . . .

MAP IV.
by Richd A. Proctor.

The linear scale radially is uniform throughout; the thwart scale is greater by 1/55th half way to the edge, and by 1/14th at the edge.

Scale of Miles at centre of map, and radially all over map
English Miles
0 50 100 200 400 600 800 1000

Small areas are greater by 1/27th half way to the edge, and by 1/7th at the edge.

E. Wd Weller del.

THE ONE-SCALE ATLAS.

WE give another map of this series, reserving an account of the method in which the sphere has been divided, and each map projected, till our space is less crowded.

THE LETTER "H" IN ENGLAND.

A LETTER recently appeared in the *New York Tribune* of September 27 on the use and misuse of the letter "h" in England, in which some very absurd mistakes were made. This is a subject of much greater difficulty and complexity than many imagine. During my lecture-travels in England I have made many inquiries into the diversities of usage in regard to the letter "h" in different parts of the old country, and into the changes which have been noticed by provincial families during the last forty or fifty years. The results have been rather curious and somewhat difficult to interpret. They tend, however, to show that the habit of dropping the "h" has spread from the large towns—as if it was a habit resulting from that slurring of speech which is apt to occur where men are always busily at work. In dull and quiet places, "far from the madding crowd," resistance against the slurring of the "h" has continued longer. In fact it was not until the rapid extension of railway communication, in the years 1835 to 1845, that the provinces were overspread by the careless way of using the "h," which had long prevailed in the metropolis and around busy centres.

The use of an aspirate where no aspirate should be is a fault which, though now nearly as widespread as the dropping of the "h," is of later origin. It arose apparently from the felt necessity for some strengthening of the language (enervated by lost aspirates) when emphasis was required. It is commonly supposed, especially in America, that among the ill-cultured in England the "h" is habitually dropped where it should be used, and thrown in where it has no business. But this is a mistake. When in an American newspaper "han Henglishman his made to hex-haspirate 'is haitches" after that fashion, every Englishman recognises the incorrectness of the caricature. In the well-known comment by a veterinary surgeon, in one of Leech's pictures, "It ayn't the 'unting as 'urts 'im, it's the 'ammer, 'ammer, 'ammer along the 'ard 'igh road," there is not one word, except perhaps "ayn't," which, according even to the worst Cockney dialect, will bear the extra or exaspirated "h." An average reporter in an American paper would certainly write the sentence, "Hit hayn't the 'unting has 'urts 'im, hit's the 'ammer, 'ammer, 'ammer halong the 'ard 'igh road," which would be quite wrong. It will be news to many (especially in America), I suspect, but it is the simple fact, that the exaspirated "h" is not only limited in its use, but is often recognised in a word which *requires* an aspirate. Nay, one can recognise one whose aspirations are a recent and, as it were, artificial development by the way in which he aspirates the "h" in such words as "house" and "horse." I have a friend, a well-read man, unfortunately sent by his father to schools where it was not thought worth while to be strict about the "h's," who avoids the use of the "h" in words where he knows it should be used, because he is conscious that an exaspirated "h" where an "h" is needed sounds worse to practised ears than an "h" dropped altogether. When a friend asks him why he does not aspirate his "h's," knowing, as he does well, where they are wanted, he will say, "Oh, *h-h-hang* your aitches!" in a way showing that it is not for want of aspirational power that he drops them.

The writer in the *New York Tribune* makes the preposterous statement that the Englishman of the upper ten thousand objects to the correct use of the letter "h" by servants and small tradesmen. There may be occasional snobs who express such a feeling, though I have never come across any; but such cases must be altogether exceptional. So far from having any feeling of this sort, an English man or woman of the so-called upper class will often show undue condescension for those who blunder over their "h's" by correcting mistakes somewhat too pointedly. I know that many of the kindlier sort—the really better sort in the so-called upper classes—are often divided in their mind between their fear of offending servants by correcting wrong "h's" and the wish to set them right. Some of the less-cultured are very touchy about such correction; others have sense enough to invite it.

The same writer, whose letter was in fact a congeries of blunders, dwells on the entirely correct use of the "h" in England among the well-educated classes. But in England our "whys" and "whens," our "whiches," "wheres," and "whethers," are much too apt to be confounded with "wise" and "wens," with "witches," "wares," and "wethers." So widely is the fault spread that many of our educational authorities insist on "w" for "wh" as correct. A generation or so ago this was not the case, and a well-educated man would as soon have said "Vot's o'clock" as "Wot's o'clock." In America, careful though Americans are about the letter "h," the distinction between "rhyme" and "rime." "Rhode" (Island) and "road" is not so constantly attended to as I had expected.

Throughout the whole English-speaking community the original sound of "h" after "t" and "d," has long since been lost. As the very existence of the two sounds we now represent by "th" serves to show us, there is no connection whatever between the sound of "th" in "thought" or in "that" and an aspirated dental. I should have mentioned Ireland, however, as an exception, for there we still hear the old sounds in "d'his and d'hat," "t'ought" and "t'ousand."

I am satisfied the aspirate originally had a guttural sound in the English, as probably in other languages—at least in many words. Otherwise we should not find "horn" and "corn" associated in English (or "horn" representing "cornu") any more than we should find the Latin "hortus" related to the Greek "chortos" on the one hand, and our own "garden" on the other. What was the sound which the Anglo-Saxons represented by the spelling "hwat"? I fancy it was a sound such as we still hear in parts of Ireland, where in sharp or ejaculatory inquiry the word "what?" sounds almost like "quhat." It is well known that in old Scottish our "wh" is nearly always written "quh." Again, the undoubted guttural in the old sounding of "light," "sight," &c., was represented in Anglo-Saxon by the letter "h" alone, in the strange spelling, "liht," "siht," &c.

STUDIES WITH A SMALL TELESCOPE.*

IT does not seem to us just that this admirable little treatise should be left unnoticed in these columns merely because the greater portion of the matter first appeared in KNOWLEDGE. Even if the plan and scope of the treatise had been suggested by the editor of KNOWLEDGE, there would still be room for remarks on the way in which the work has been done. But as a matter of fact, the plan of the work was as entirely Captain Noble's as the execution has been.

We regard this book as one of the best introductions to

* "Half-hours with a 3-inch Telescope." By Captain W. Noble, F.R.A.S. Longmans & Co.: London.

telescopic work extant. To use an American expression, it fills the bill, and it does not more than fill it. Other works there are which contain either too much or too little—that is, considered with reference to the wants of the astronomical student. Here there is enough to occupy the attention of the amateur astronomer, while there is not enough either to deter him, by suggesting the idea that an immense number of objects must be studied before he can be regarded as having fairly entered on astronomical research, or to engage him in the time-wasting work of studying multitudinous objects of the same class with no special purpose in view. We happen to know that quite a number of intending students of astronomy have been driven from the proposed pursuit by the mere aspect of works in which multitudes of insignificant lunar details, thousands of records of planetary observations, and myriads of measurements of close double stars are recorded as matters worth studying. Many times we have been told that astronomy cannot be worth studying (outside official observatories for commercial astronomy) if for proficiency it requires its students to devote days, months, and years to

> Collecting toys
> And trifles for choice matters, worth a sponge;
> Like children gathering pebbles on the shore.

Now in Captain Noble's book just about as much attention is directed to each subject as it fairly deserves, and this has been done in such a way as to attract instead of repelling the student. A student who works through the series of observations described or suggested here will have done fully as much as is necessary to prepare him for serious work if he is able or inclined to enter on it. On the other hand, should he be content, as most men must be, to regard astronomy merely as a department of scientific study, he will not feel that he has given more attention to the subject than it fully merits. He will have derived much pleasure from the work of observation, his views will have been enlarged, and a measurable addition will have been made to the value of life. (We take it the chief value of scientific research outside definite gains from nature, resides in the answer which the study of truth gives to the vain yet persistent question, "Is life worth living?")

The introductory matter on the telescope is excellent, though it might be usefully supplemented by certain instructions which the beginner nearly always requires before he can get a telescope to work satisfactorily. In particular, the telescopic study of the sun requires some limits which Captain Noble has omitted to supply. His suggestion that to diminish the risk of the dark glass cracking, the aperture of the telescope should be reduced from three to two inches is sound enough so far as safety is concerned; but the plan involves a very serious diminution of defining power. The chapter on the moon is admirable, infinitely better calculated to attract students to the telescopic study of our satellite than the big but disheartening treatises mentioned by our author. We are glad to see by the way that he has put his foot down very definitely in the matter of lunar nomenclature. Four hundred names appear in the map and accompanying list, and surely four hundred are sufficient. A study of the moon involving the examination of more and minuter objects may be aptly compared in value to the enumeration of individual hairs upon the tail of the conventional cow. This we know would have seemed rank heresy to that dear old lady Mr. Birt, and will be rejected scornfully by his selenographical successors; but we shall wait until their elaborate work has added one single live fact to astronomical knowledge before we admit that we have erred.

We note only one point in the chapter on the moon which is open to question, and that does not belong to the subject proper of Captain Noble's treatise. He mentions as an inexplicable fact the notable darkening of the floor of Plato towards and until shortly after the time of full moon. We venture to deny that any such darkening takes place; and we are sure that if Captain Noblo will follow our own method of testing the matter, using a Dawe's eye-piece or other device for getting rid of the effect of contrast, he will be satisfied that his inexplicable fact is a very readily explicable illusion. There is, however, a very simple proof of this in lunar photographs. We possess a very fine series of twelve photographs by Rutherfurd, showing the moon in all her phases. A careful comparison of these shows unmistakably that the floor of Plato grows lighter, not darker, as the sun's altitude above it increases.

The chapters on the planets are excellent. They are as interesting as the corresponding chapters in the first edition of Webb's "Celestial Objects:" before that work was overloaded with uninteresting details, and so deprived of much of its effective value. We observe that Captain Noble gives the rotation-period of Mars as 24h. 37m. 22·735s. We doubt very much whether Mr. Proctor ever attached any real value to the second and third decimal digits. The only thing proved about the rotation of Mars is that in which Mr. Proctor and the late Professor Kaiser of Leyden agreed—after the correction of two clerical errors of Kaiser's. Comparing the observations made by Hughens and Hooke with those made in the years 1864 to 1882, the rotation period of Mars has been shown to be 24h. 37m. 22·7s., within certainly less than 0·05s. either way.*

The treatment of double stars in the chapter on "Fixed Stars and Nebulæ" is admirable. Fifty double stars or so, including all the typical varieties, are described and pictured—enough to interest and instruct, not enough to weary. In fact, with so simple and attractive a way of presenting the subject, as many more might have been introduced, and no harm done. Yet we are glad that Captain Noble resisted the temptation; for though the student might have gone on unwearied, he has, as it is, been taught the useful lesson, much needed in such matters—*ne quid nimis*.

We do not care to note trifling *corrigenda* or defects in a work so excellent as a whole as this. We may mention, however, that the method of drawing ellipses with pins and a thread is not worthy of a place in Captain Noble's book. With far less trouble than the student would have to take in getting his pins rightly placed and the string of the right length, a much better ellipse may be drawn. We speak with some experience, having drawn many thousands of ellipses. The construction for representing the gibbous phase of Mars (see pp. 81, 82) is not quite correct: it is better to give the true elliptical form to the terminator. One other slight suggestion we would offer. It may seem hypercritical, but we somewhat object to the description of Mr. Ward's unusual keenness of sight as "almost supernatural" and "quasi-miraculous." It is exceptional, possibly unique; but the terms used by Captain Noble imply that it is not merely marvellous in degree (as assuredly it is), but in kind (which assuredly it is not).

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* Others have since pretended to correct this by combining later observations with the mean of other estimates, including Kaiser's two estimates *before* the clerical errors were detected. But this last mistake is manifestly absurd; and though each succeeding opposition of Mars must necessarily enable us to improve our estimate of the planet's rotation period, half a century at least must pass before any correction amounting to one-twentieth of a second can be introduced in this way. The estimates of William Herschel, Mädler, Secchi, and Schmidt were less exact than Proctor's and Kaiser's (which were practically identical), but they were independent: those proffered by Messrs. Denning and Bakhuysen have no independent value whatever.

BIRTH AND GROWTH OF CHRISTIANITY.*

READERS of KNOWLEDGE, since the first monthly number appeared, will find much to interest them in Mr. Janes's excellent, carefully thought out, and well-written treatise on the early history of Christianity. He presents much of the evidence to which we have only directed readers' attention, not having here had space fully to consider it. He has also collected much matter on which, in our treatment of the subject, we have not hitherto touched.

The guiding idea of the work before us is that conveyed in the maxim of Confucius, that "The superior man does not set himself either *for* anything or *against* anything; what is *right* he will follow"; and again in the terser text of Paul, "Test all things; hold the good."

After a brief introduction, Mr. Janes sketches the condition of Palestine in the Roman period, and the society and religion of the Roman Empire. In the first of these chapters he presents, *inter alia*, interesting matter relating to the Essenes. Though inclining to the belief, which we must confess we do not share, that the doctrines and practices of the Essenes originated in Palestine by a natural evolution out of Pharisaic Judaism, he admits that obviously Eastern notions, chiefly of Zoroastrian origin, had been gradually creeping into the thought and faith of Israel. The penetration of Buddhist ideas to the more earnest of the Pharisaic separatists, after a process of filtration through Zoroastrianism, seems to us a far more reasonable explanation of Essenism than any process of evolution from Pharisaic Judaism.

In the account of Religion in Rome, perhaps the most interesting matter is that relating to oriental influences. The success of the worship of Mithra, when introduced by the Emperor Commodus towards the close of the second century, is full of significance, especially when associated with the influence which the worship of Serapis had had on the Romans during two preceding centuries. Renan goes so far as to say that, "Had not Christianity taken the lead, Mithracism would have become the religion of the world." It is not absolutely certain, however, that the Christianity which actually did find favour among the Romans, or at any rate the ritualistic part of such Christianity, was not simply the disguised worship of Serapis—that is to say, sun worship, and therefore Mithracism in another form. Mr. Janes mentions, though with little idea apparently of the significance of what he notes, that

> Even after the secular ascendency of Christianity the ritualistic worship of Mithra was handed down from age to age through the esoteric order of the Rosicrucians and the secret societies of the Middle Ages. The ceremonies observed in the worship of Mithra are described by Tertullian, a Christian writer of about 200 A.D., as strongly resembling the sacraments of the Church. The initiates were admitted by a rite of baptism. They worshipped in little chapels, similar to Christian churches. They made use of a species of eucharist, eating the sacred bread, draōna, accompanied by solemn religious ceremonies, while the neophyte was tested by twelve consecutive penances. As in the Eleusinian Mysteries, the doctrines of a life after death, the resurrection of the body, and a future state of rewards and punishments, were taught by Mithraeism. The influence of this new religion upon the thought and literature of the time was absorbing and all-persuasive.

The Gnostics doubtless borrowed largely from Mithracism; and the popular sects of Judaism are also thought to have derived many of their rites and doctrines from kindred mysteries, through Babylonia. The indirect influence of these conceptions upon the current and subsequent development of Christian doctrine was doubtless considerable. The leading Mithraic festival, celebrated at the winter solstice, identical in time with the Roman Saturnalia, was ultimately assimilated by Christianity, and recognised as commemorative of the birth of Jesus, which the apostolic tradition had assigned to the spring-time instead of the 25th of December.*

Further on Mr. Janes makes the following pertinent remarks on the position of religion in the West and in the East nineteen centuries ago:—

> Rome, with her State religion—a hollow ecclesiasticism to the more intelligent—stood ready, at the demand of self-interest, to dethrone Jupiter, and to pass over the temples of her gods, her images, her festivals, the paraphernalia of her priests, and the title of Pontifex Maximus, then held by Cæsar as the head of the Pagan cultus, to that new religion which, through the supremacy of the empire among the nations of the world, was soon to make such mighty strides toward universal dominion. Her sculptured heads of Jupiter were to descend to posterity, rechristened by the name of St. Peter, and her little god Vaticanus, whose function it was to watch over the first lisping of infants, was to bestow his name upon the Vatican—the palace of the Christian popes. The great Aryan monotheism of Zoroaster had met in Babylon the great Semitic monotheism of the Hebrew prophets, and, together with some more questionable benefactions, had blessed it with its gift of a belief in a life beyond the grave, and thus prepared the way for one of the leading doctrines of Christianity. The word "Father" as applied to the Supreme Being had entered Judaism from that other contact with the Aryan races through the Greeks, and was used by Jewish Rabbis of the century preceding the birth of Jesus. The Hebrew doctrine of the Messiah had taken a new and more personal form under the influence of contemporary Persian notions, and the stimulus of foreign oppression. Millennial expectations imported from Babylon were "in the air." The writers of the Book of Daniel and the apocryphal Book of Enoch had applied the term "the Son of Man"—a common designation of the prophets—to designate the coming Messiah. Hillel had already proclaimed the "golden rule" ("Do not to others what thou wouldst not they should do unto thee") as the substance and foundation of Judaism.

These two chapters are only introductory to the body of the work, in which the subject of the origin and progress of Christianity is very fully and fairly considered. Mr. Janes, while pointing out the impossibility of reconciling the narratives in the three first Gospels, even with each other, and the complete incongruity of the fourth Gospel, manifestly the work of a Gentile Gnostic, admits as genuine much more of the specifically historic matter in the Synoptic Gospels than we can for our own part accept. But he gives his reasons, and shows how he has weighed them: he does not mislead by dogmatic assertion. Of course he rejects as manifestly developed from the solar myth the whole account of the birth and youth of Christ.

The following passage presents the general result to which Mr. Janes has been led in regard to the character, the opinions, and the views of the founder of Christianity:—

> We have attempted, fairly, with no bias of preconceived opinions, to set forth the leading features in the teaching of Jesus on its theological side, as reported in the Synoptical Gospels. While recognising the fine humanity of his doctrine of the fatherhood of God and the profound sincerity of all his beliefs, there is evidently much in this teaching which the liberal and cultured thought of modern times has for ever discarded, much that bears the impress of a primitive and ignorant age and of a narrow and restricted intellectual environment. For us there is no encompassing host of demons, no personal prince of evil, no bodily resurrection, no eternal kingdom of immortals to be established upon the earth. If we still hold to the fatherhood and personality of God, it is in quite a

* "Primitive Christianity." By Lewis G. Janes, Index Association, Boston.

* The cross was a Mithraic symbol long before the advent of Christianity. It also constituted one of the eight altar implements of the Buddhists, and from very early times had been recognised as the sacred symbol of the god Nilus in Egypt. It is also of frequent recurrence in those buried cities of the Troad which Dr. Schliemann has recently exhumed.

different sense from that embodied in the simple, anthropomorphic conception of Jesus. The Messianic doctrine of the Jews is to us a beautiful dream, which the Prophet of Nazareth did not fully realise either according to the popular expectation or his own more spiritual interpretation. Not in any of these theological conceptions do we find the secret of the influence of Jesus upon the life and thought of later generations.

THE "SATURDAY REVIEW" ON BEECHER.

NOTHING more discreditable to English journalism has appeared for years than the attack made by the *Saturday Review* upon the memory of America's great preacher, Henry Ward Beecher. It is not known in America so well as it is in England that such attacks in English journals have in reality been directed against Beecher rather as an advocate of a policy not now fashionable in the old country, than against Beecher, the "lapsed Congregationalist" (whatever intensity of reproach those "very bitter words" may imply). Americans, thus ignorant of the real meaning of the attack, can only wonder that the editor of a paper pretending to any position in respectable journalism should have allowed an article to appear which, apart from the bad taste shown in every line, is so inanely irate that its venom is neutralised by its folly.

If Mr. Beecher had been the feeblest preacher or teacher that had ever addressed a congregation, if he had been even the offensive blasphemer imagined in the *Saturday Review*, it would have been grossly offensive to dwell on such shortcomings at a time when his own people were mourning his loss. But Beecher was a man of whom America was justly proud. What was said of him in the *Saturday Review* might unfortunately be very truly said of many preachers in America, as it might be said of many in the old country. Too many preachers in both countries have striven to obtain a false popularity by vulgar tricks, by coarse buffoonery, and by scarcely veiled profanity. But Beecher was never one of these. The *Saturday Review* even mistakes (if it does not wilfully mis-state) in suggesting the idea that Beecher strove to attract his audiences by pulpit-jesting. The touches of humour which may be noted in his sermons, as reported or written, are characteristic enough, it is true, but he appealed always to the reasoning faculties of his hearers, not to their sense of fun or to their love of amusement.

Each Monday the leading papers in the United States publish the sermons of those who are regarded, rightly or wrongly, as the leading American preachers. The bulk of such matter is very poor reading. Most of the sermons thus published are vulgar or silly or offensively unchristian. A paragraph or two from one of Talmage's sermons will more than nauseate a reader of average taste and intelligence by its disgusting imagery, its charnel-house metaphors, its illustrative references to ulcers, cancers, putrefaction, and other unseemly matters. The vulgarity of the much-followed "Sam Jones," his amazing self-sufficiency, and the way in which he condemns to eternal torments all who differ from him, cause even less than a paragraph of his sermonising to thoroughly sicken all but the strongest-stomached reader. And though others among the preachers are not so bad as these, few manage to preach or to write sermons which any one of taste or culture can read with patience. But everything Beecher allowed to appear in this way was worth attentive study. He was never dogmatic or overbearing. He did not even seem to desire to teach his hearers what they should believe or do. Always his tone was as of one striving after the truth. He seemed rather to ask, "Ought not *we* to think and act thus?" than to say, "*You* ought thus to believe, and by these rules to guide your conduct."

I have myself so intense a dislike to the usual tone of preachers that my opinion of a man in Beecher's position would be apt to be somewhat influenced by prejudice. I recognise in myself here an idiosyncrasy which would tend to make me unfair towards preachers generally, though I can maintain conscientiously the position that in the great majority of cases preachers, by the mere fact that they deem themselves competent to teach other men their duty, are objectionable in the sense in which the Pharisees seemed objectionable to the founder of Christianity. But Beecher belonged to that small minority among preaching men who, while they possess great power of exposition and persuasion, are more anxious to seek out the truth for themselves than to convince their fellow-men. Herein I take it lay the charm of his teaching and the secret of his influence, though I can only guess this by reading his sermons, having never heard him preach.

The *Saturday Review* quotes two passages from Beecher's sermons as showing such inanity that to compare him even with Mr. Spurgeon needs apology, which it proffers; and we all know what intensity of spite an apology from the *Saturday Review* implies. One of these passages is admittedly taken away from the context, and is thus so altered in character as to be unmeaning. The other affords a rather curious illustration at once of Beecher's turn of mind and of the mistake into which the *Saturday Reviewer* has fallen (let us charitably suppose) in treating him as a humourist of the pulpit. Said Beecher, speaking of Colenso's inquiries into the Pentateuch, "What if there are mistakes in the books ascribed to Moses? If there are, the mistakes are there; that is all. What if it shall be proved that Moses did not write those books? Then it is proved that he did not write them; that is all. What if some of the books which have been by many men considered divinely inspired, must be otherwise regarded? Then we must not deem them God's word; that is all. And what are we to say of those that are still left? We must accept them as still left us; that is all."* If this were the beginning and end of an argument, it would doubtless be unsatisfactory, except for hearers quick to apprehend the underlying meaning. But the words quoted form only part of a very characteristic piece of pleading. Beecher appeals to men to accept the truth as they see it, without the fear (implying want of faith) that the truth can do them harm. Underlying his appeal, we see the recognition of the way in which many weakly strive to blind their eyes to the truth. Beecher urges men to be less timid. Oh ye of little faith, he seemed to say, wherefore do ye fear? Why must you wish to offer to God the unclean sacrifice of a lie? That Beecher practised what he thus taught, and that he suffered for so doing, is well known in America. The coarse abuse of science, and especially of the doctrine of evolution, in which Talmage and his fellows revelled, was undoubtedly much more profitable for them than Beecher's ready, and even reverent, recognition of demonstrated truths. But the judgment of all the better sort of men approved the faithful honesty of Beecher, impolitic though it doubtless was, and scorned the pretended earnestness of hypocrites.

On one other point let me touch but for a moment. It has been asked with much derisive sneering, how America

* The *Saturday Review*, speaking of this passage, says it declines to recognise in it a specimen of American humour. As reasonably might it be said of American wheat that it cannot be regarded as good tobacco.

can love and reverence a man whose name was darkened by an accusation never wholly disproved. I know not by what right a charge not wholly disproved can be urged against a man's memory as though it were an accusation fully proved. Even had the charge been proved, however, it would have been one involving no such deliberate iniquity, and suggesting no such innate depravity, as average minds find in the conduct of one who (we are told, and many believe) was loved above all other men by God. If God could condone David's greater guilt of kindred nature, covered (to men's eyes) by deliberately planned murder, men may surely forgive the lesser offence, which for the moment is assumed to have been committed by Beecher. But it is worthy of careful consideration that while doubtless many thousands in America believe that Beecher was guilty in that matter, the proportion of those who utterly reject such belief is found to be greater the nearer we approach the centre of his ministry. At that centre all believed and believe in his innocence, seeing only the plots of enemies in the attack upon his character.

THE LOUISIANA LOTTERY.

By Richard A. Proctor.

THE greed for chance-won wealth is so great among men of weak minds, and they are so large a majority of all communities, that the bait may be dangled for them without care to conceal the hook. In all lotteries and gambling systems which have yet been known the hook has been patent, and the evil it must do if swallowed should have been obvious. Yet it has been swallowed greedily.

A most remarkable illustration of the folly of those who trust in luck, and the cool audacity of those who trust in such folly (with more reason but with more rascality) is presented by the Louisiana Lottery in America. This is the only lottery of the kind now permitted in America. Indeed, it is nominally restricted to the State of Louisiana: but practically the whole country takes part in it, tickets being obtainable by residents in every State of the Union. The peculiarity of the lottery is *the calm admission, in all advertisements, that it is a gross and unmitigated swindle*. The advertisements announce that each month 100,000 tickets will be sold, each at five dollars, shares of one-fifth being purchasable at one dollar. Two commissioners—Generals Early and Beauregard—control the drawings; so that—we are told, and may well believe—the drawings are conducted with fairness and honesty, and in good faith to all parties. So far all is well. We see that each month, if all the tickets are sold, the sum of 500,000 dols. will be paid in. From this monthly payment we must deduct 1,000 dols. paid to each of the commissioners, and perhaps some 3,000 dols., at the outside, for advertising. We may add another sum of 5,000 dols. for incidental expenses, machinery, sums paid to agents as commission on the sale of tickets, and so forth. This leaves 490,000 dols. monthly if all the tickets are sold. And as the lottery is "incorporated by the State Legislature of Louisiana for charitable and educational purposes," we may suppose that a certain portion of the sum paid in monthly will be set aside to represent the proceeds of the concern, and justify the use of so degrading a method of obtaining money. Probably it might be supposed that 24 per cent. per annum, or 2 per cent. per month, would be a fair return in this way, the system being entirely free from risk. This would amount to 9,800 dols., or say 10,000 dols., monthly. Those who manage the lottery are not content, however, with any such sum as this, which would leave 480,000 dols. to be distributed in prizes. They distribute 215,000 dols. less, the total amount given in prizes amounting to only 265,000 dols. If the 100,000 tickets are all sold—and it is said that few are ever left—the monthly profit on the transaction is not less than 225,000 dols., or 45 per cent. on the total amount received per month. This would correspond to 540 per cent. per annum if it were paid on a capital of 500,000 dols. But in reality it amounts to much more, as the lottery company runs no risk whatsoever. As I pointed out recently, in the *Newcastle Weekly Chronicle*, the Louisiana Lottery is a gross swindle, besides being disreputable in the sense in which all lotteries are so. What would be thought if a man held an open lottery, to which each of one hundred persons admitted paid 5*l.*, and taking the sum of 500*l.* thus collected, were to say: "The lottery, gentlemen gamblers, will now proceed; 265*l.* of the sum before me I will distribute in prizes, as follows" (indicating the number of prizes and their several amounts); "the rest, this sum of 235*l.*, which I have here separated, I will put into my own pocket" (suiting the action to the word) "for my trouble and expenses in getting up this lottery." The Louisiana Lottery is a transaction of the same rascally type—not rendered more respectable by being on a very much larger scale.

If the spirit of rash speculation will let men submit to swindling so gross as this, we can scarcely see any limit to its operation. Yet hundreds of thousands yield to the temptation thus offered, to gain suddenly a large sum, at the expense of a small sum almost certainly lost, and partly stolen.

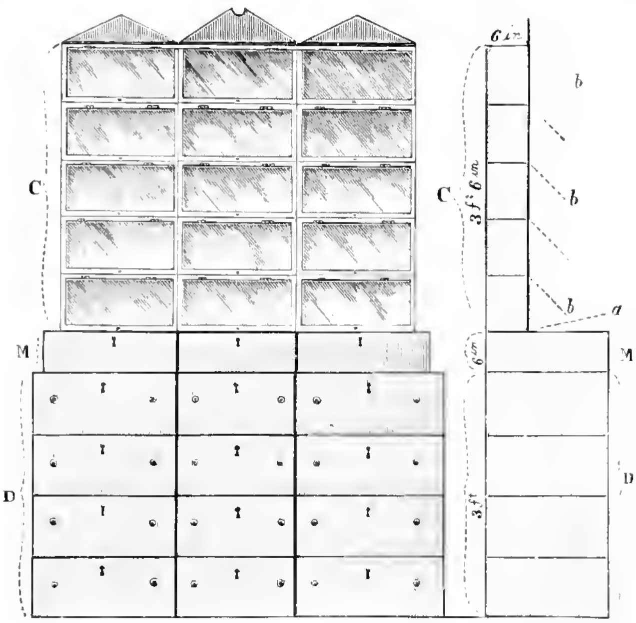
THE NATURALIST'S LABORATORY.

CONTRIBUTION VII.

Laboratory Furniture—(*concluded*).

THE student's workshop cannot be regarded as even fairly well equipped unless adequate provision is made for the convenient storage of specimens, the reception of books and instruments, and the temporary sheltering of work in course of progression. Cabinets, cases, and boxes, to meet each special want, are thus found necessary, and it is therefore incumbent on us to point out or describe the forms of the articles best suited to the naturalist's requirements.

The old-fashioned cabinets replete with drawers, and trays within the latter, can scarcely be improved upon for holding geological or dry biological specimens. Each drawer can be numbered and indexed with a list of its contents, and when the trays are removed and placed upon a table they show at a glance the various objects, which may be displayed with as much effect as in the wall cases of a public museum. Such cabinets ought to form the basal moiety of the storage area, as shown by the accompanying sketch, fig. 1. The upper portion of the case may conveniently be reserved for holding cases of instruments, such as dissecting tools, microscopes, &c., in a large box made to stand upon the top of the chest of drawers, and provided with a hinged lid to open upwards, as shown in the side plan, fig. 1, *a*; the dotted line shows the position of the opened lid. Upon the top of this instrument case there should be piled a series of narrow boxes, *c*, fig. 1, each one of which should be faced with a glass door hinged to its upper edge, and made to open outwards and upwards, as indicated by the dotted lines *bbb*, in the side plan (fig. 1). These boxes will be found invaluable for the permanent places of such articles required for constant use or reference, and which are liable to be affected or destroyed by even a nominal accession of dust; *e.g.*, the microscopist's bottles of mounting media, staining reagents, spirit lamps, the boxes used for the storing of microscopical slides, &c., the best form of which will be detailed presently. The component parts of the entire structure should be fastened together with screws and bolts for the sake of firmness. It need scarcely be added that the composite structure thus built up may be made of any size to suit the particular wants of any special laboratory, but the dimensions given on the annexed diagrams will be found of service in nine cases out of ten. The front elevation shows three such cases placed side by side, from which it may be gathered that, as the stores within the laboratory increase, the dimensions of their future homes can as readily be added to. Again, as each box (c, fig. 1) is complete in itself, it may at any time be removed and replaced by one of greater or less



Front elevation. *Side section.*

Fig. 1.—The Naturalist's Store Case.
c, upper boxes; m, instrument box; d, specimen chest; *a*, position of lid of instrument box when opened; *b b b*, position of lids of upper boxes when opened.

height. Apart from the portability of the structure, this device is better calculated to guard against the incursion of dust and dirt, which, as has before been noted, is of primary importance to the practical students of nature. A large box, constructed upon the book-case principle, with adjustable shelves and large doors with panels of glass, will not be found more convenient for ready access as may upon first thoughts be imagined, and is furthermore prone to the collection of quantities of dust which would necessitate frequent and laborious cleansings. With the portable boxes each set of appliances can be separately kept, easily replaced, and each compartment can be separately wiped out as occasion may arise. Another important advantage to be gained by the adoption of the plan is, that the worker can construct his own cabinet piecemeal from time to time, with but very little skill, and at a very trivial expenditure. The author was led to devise it gradually: he first of all commenced by placing a series of small rough wooden boxes, such as can be procured from any grocery or oilman's stores, at the cost of from one to threepence a piece, one over the other, upon a cheap chest of bedroom drawers. Certain of these boxes were set apart for microscopical requisites, such as Canada-balsam phials, spirit lamps, porcelain dishes for sections in course of preparation, &c., all of them necessitating a dust-proof yet easily accessible lodging; and these were accordingly provided with small panes of glass framed, and hinged upon the upper edge of each box. The central case for instruments soon suggested itself, and an "egg-box" was found which exactly fitted upon the top of the chest of drawers, which were then all filled with geological chips. With but scanty skill and a little taste the whole case may be rendered a handsome piece of furniture, worthy of a well-appointed laboratory. The insides of the boxes may be lined with pieces of white cardboard, and their ungainly edges covered by a neat framework made of picture-frame mouldings, sufficient of which can be procured for a few pence. The cabinet of drawers, placed lowermost, may also be made upon the portable plan, and the trays full of specimens be virtually adapted from empty "soap-boxes," provided with framed glass lids, and divided into suitable compartments within for each separate specimen. The soap-boxes thus utilised can then be merely piled one over the other loosely within each larger box, which forms an integral part of the whole lower case. By degrees, all the available floor-space adjoining the walls of the apartment can thus be utilised to the best advantage, and there will thus be afforded a highly suitable place for everything likely to be required in the laboratory.

By a modification of the portable upper boxes into ordinary cases of large size, fitted with adjustable shelves, ample space will be provided for such books, pamphlets, and papers as the worker may possess which bear upon the subjects of his studies; and similar shelves can be set apart whereon to place bottles and jars containing specimens for display, or working material, such as plants and animals in spirit, &c., mounted osteological and other preparations under glass domes or cases, &c.

One case of upper shelves may be set apart to hold microscopical slides, upon the following improved principle:—Take, for example, a collection of preparations illustrative of the *Rhizopoda*. A small typical series may be contained in two book-boxes labelled respectively *Foraminifera* and *Radiolaria*, placed endwise, as usual with printed volumes, upon a shelf. Each box, to take the English standard sizes, may be made to hold either twelve or twenty-four slides, in an ordinary rack work within. When the boxes are placed upright upon the shelf, the slides will be *horizontally* disposed, and thus run no risk of displacement of the objects, by gradual subsidence, as sometimes happens when the same boxes are laid flat upon a table. An index of contents may be fastened upon the inner side of the lid of the box, and with a little care the student will soon fall into the good habit of numbering each preparation, and always placing it in the slit corresponding to that number upon the index. By the adaptation of a simple movable wire, hooked at each end, and capable of adjustment within eyelet holes, one at each extremity of the box, as graphically explained by fig. 2, a holdfast will be obtained, which can be removed and readjusted with the utmost facility, secures each slide in its place, and prevents it effectually from falling out of the box, even when the latter is carelessly or suddenly opened. The advantages of such a system are undeniable; the specimens are held firmly in a horizontal position, a *sine quâ non* in the storage of such things, and any object desired can be found at a moment's notice by a reference to the outer title on the back edge of the box, and a glance at its table of contents affixed to the inside of the lid. The forms of microscopical cabinet now in common use are, many of them, both cumbersome and inefficient. The large handsome boxes with their sliding trays, it is true, keep the slides in a horizontal position, but that is about all. The author was once the unhappy possessor of a piece of furniture of this sort, but got rid of it on account of two very grievous faults. The sliding trays, after exposure to unlooked-for damp, became slightly warped, and every time that they were withdrawn or forced home a considerable amount of jerking was occasioned, and terminated fatally

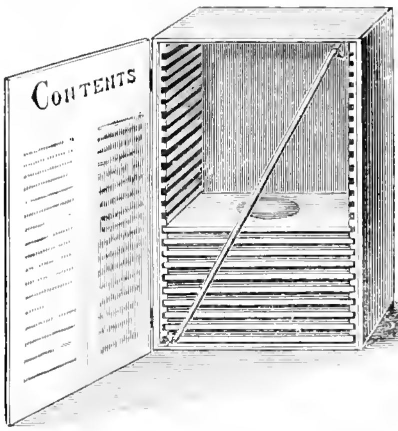


FIG. 2.—BOOK BOX FOR THE STORAGE OF MICROSCOPICAL SPECIMENS.

for some of the choicest preparations within; they were thrown one upon the other, and became inextricably united. Every time the ponderous case was moved the slides had to be shifted into rack-boxes temporarily and then carefully rearranged in the cabinet on arrival at the new destination; a labour by no means pleasant nor easy of performance when the cabinet is a large one and well filled. Ordinary small pine or mahogany cabinets, with divided lifting trays, are all very well for very small collections, and when sets of objects are to be carried away for displays, &c.; but their presence upon the laboratory table in anything beyond one or two cases is decidedly out of place, and most emphatically "in the way."

In addition to the furniture, properly so called, for the laboratory, there are various items which cannot either be classed under the heading now discussed nor as part and parcel of the instruments which call for a description in the future completion of these papers; they necessarily waver between the two, and will therefore form the subject of the next contribution as "laboratory requisites."

Gossip.

By RICHARD A. PROCTOR.

A CATHOLIC (Roman) monthly magazine takes me to task, in somewhat schoolboyish fashion, for questioning the authenticity of the well-known passage in Tacitus, in which the Christians are described as malefactors justly punished as enemies of the human race, though so cruelly as to excite the sympathies even of those who recognised their wickedness. It has always appeared to me, from the time when, as a boy, I first became acquainted with this remarkable "evidence of Christianity" (to use Paley's ungrammatical expression) that the friends of Christianity would rather it were proved to be an interpolation than see it established as genuine. Paley says that the words of Tacitus *prove* that the founder of Christianity was put to death. If the passage is genuine, Tacitus *states* that one Christus suffered death in the reign of Tiberius, under the procurator Pontius Pilate. But since Tacitus was born at least twenty years after Tiberius died, and wrote his "Annals" more than thirty years after the destruction of Jerusalem, and more than seventy years after Pontius Pilate was ordered to Rome (A.D. 37, because of his harsh treatment of the followers of an impostor who misled many Samaritans), it is difficult to see how any statement of his about the origin of Christianity can be regarded as *proving* anything. If the passage is genuine, and a statement by Tacitus is to be regarded as affording proof demonstrative, then it must be regarded as proved that the Christians in the time of Nero

(1) were held in abhorrence for their crimes;
(2) were shown by their conduct to be veritably enemies of the human race;
(3) were held, even by the most tolerant, to be deserving the severest punishment.

* * *

LUCKILY there are abundant reasons for regarding the statement as of no weight whatsoever, whether a forgery or genuine. We know that at the beginning of the second century, when Tacitus wrote his "Annals," many related what his statement has been held to prove. He manifestly had his information, if he wrote that statement at all, from those who repeated what was currently said in his day about the events of the days of Nero (who died when Tacitus was quite a small boy). There was probably not a particle of real evidence to show that the Christians, who very likely were persecuted by Nero with the ferocity described by Tacitus, were really malefactors, or even generally said to have been so at the time of the persecution. It is impossible to imagine that any records (of the slightest real value as evidence) could have been accessible when Tacitus wrote his "Annals," by which the actual circumstances of the persecutions carried on by Nero could have been ascertained.

* * *

IF such evidence as that of the doubtful passage is to be accepted at all, it must of course be accepted as it stands. If it proves anything, it proves what the Christian would prefer to see disproved.

* * *

THE same Roman Catholic magazine recommends me to read Bekker's remarks on the manuscripts of Tacitus, to correct my judgment. But alas, that remedy can be of no use to me, for it has been already applied in vain. Nothing Bekker wrote half a century ago (my copy of his edition of Tacitus is dated Leipzig, 1831) can controvert the fact that the "Annals" of Tacitus have reached us in a most imperfect state, and that the genuineness of certain portions is open to the gravest possible doubt.

* * *

MY critic volunteers further the information that the "Annals" were written in Latin, a language which admits of no distinction between "Christ" and "The Christ." I had had some inkling of this before. But the Latin language was not so utterly feeble that Tacitus would have been unable to show that the founder of Christianity was called "The Anointed." Had he been as well informed about the beginning of Christianity as Paley (for example) would have us believe, he would undoubtedly have said that the Christians were so called because the founder of their religion, a man named Jesus, had been called Christ, which in the Greek tongue signifies Anointed. To a monkish interpolator, accustomed—as we are in our own day—to speak of Jesus the Christ as simply Christ, nothing would be more natural than to write as Tacitus is supposed to have written. But nothing could well have been more unlike Tacitus than to use a Greek adjective as a proper name, if he had really known anything about the history of the founder of Christianity. And if he did *not* know anything, or knew so little, what value can his testimony possess? What even can it prove, if accepted?

* * *

WRITING at this moment away from my books (in Florida, far from any large library), I cannot state precisely how far the version of the "Annals" discovered about the year 1505 in the Westphalian Abbey of Corvey differs from others. But it is hardly necessary to remind the reader that we only know of the first five books of the "Annals" from this version, published at Rome by Philip Beroaldus, in 1515, as nearly as I can recollect.

* * *

WHAT would be said, I wonder, if the confidence with which Paley accepts the statement found in Tacitus were extended to the passage in which the Emperor Hadrian, writing to Servianus (A.D. 134), after speaking with some contempt of Egypt and the Egyptians, says, "The worshippers of Serapis (in Egypt) are called Christians, and those who are (consecrated) to the god Serapis call themselves (I find) the Bishops of Christ."

* * *

MACROBIUS (Sat. i. 20) identifies Serapis with the sun. There were two forms of the worship of Serapis, a circumstance which led Jablonsky ("Pantheon," vol. i.) to identify what he regarded as the later form with the worship of the sun in the winter signs of the zodiac. But he was probably misled by the references in the Egyptian ritual to the observances at the time of the sun's annual birth (assigned to the date December 25, as the time when first the stay of the sun's southward progress was ascertained, and the beginning of his return towards the equator recognised). The worship of Serapis found attractions for both Greeks and Romans. But for some reasons it was regarded as evil, insomuch that, tolerant though the Roman Senate was in matters relating to religion, the worship of Egyptian gods was forbidden, and orders were issued that the altars and temples erected to them should be destroyed. Later the worship of Isis and Serapis was permitted. This was about a century before the time to which the passage attributed to Tacitus relates.

* * *

IT may be mentioned here, as at least curious if not significant, that Socrates the ecclesiastical historian ("Eccl. Hist." lib. 5, ch. xvii.), writes as follows respecting the temple of Serapis:—

"In this temple, now destroyed and everywhere rifled, certain letters were found engraved in the stones—forming a cross. The Christians and Gentiles who saw this, applied it each to their own religion. The Christians asserted that this cross symbolised the passion of Christ, and was the emblem of their religion. The Gentiles affirmed that in this symbol was presented something belonging in common to Serapis and to Christ."

* * *

THE critic who has explained to me that the "Annals" of Tacitus were written in Latin may now very properly explain to me that Socrates was a philosopher who, as he was born 469 years before the Christian era, can hardly be described as an ecclesiastical historian. However, the Socrates I have quoted was born about nine centuries later. Sozomen, about fifty years earlier, gave much the same account of the Egyptian Serapis. His history ranges from A.D. 324 to A.D. 439, that of Socrates from A.D. 306 to A.D. 439.

THAT the cross on our modern hot-cross bun is of Egyptian origin is of course known to all—see, however, Bonwick's "Egyptian Belief," and Colenso on the Pentateuch, &c. It is equally well known that originally this symbol had no connection with Good Friday, but belonged specially to every Friday, Friday being the day consecrated to Freya, Venus, Isis, &c.

* * *

HERE is rather an odd coincidence. I was beginning to deal with the solution of the second of the problems dealt with this month, when it occurred to me that the work would be easier if I had a number of globes which I could arrange as pyramids, either square based or triangular, according to the requirements of the problem. As the thought passed through my mind, I remembered that it was very close to post time, and I went out to post some letters I had written, thinking I would reason out a solution, or rather the best form of presenting one, as I walked to the post office and back. This was at Lake Weir in Florida. As I crossed the threshold of the hotel, I saw a friend approaching in a buggy, with whom I shook hands. He had in his left hand a sack about half full; and he said, "Professor, I've brought you a few (!) oranges." I thanked him, and after a short chat walked on to the post office—not thinking of my problem, because I knew the oranges would be just what I had wanted, and that I could study the problem much better with them to build into pyramids than without their aid. And so it proved. They were better than globes, because when stood on the stalk side they did not roll. I do not know what idea my friend had formed of my orange-eating capacities, but he had brought me enough to make two pyramids, one triangular, the other square based, each of four oranges in the side, and this after setting on one side all the smaller and all the larger oranges, so that only oranges of medium size might be used. Observe, also, that oranges were about in such profusion that I could find no one to whom I could present any. Moreover, I was to leave Lake Weir in two days, and my valise was very closely packed already. As a mere matter of fact, I may mention that I did not eat all those oranges.

Reviews.

Popular Tales and Fictions. By W. A. CLOUSTON. (William Blackwood & Sons.)—Mr. Clouston has done good service to folk-lore by the collection of the rich material garnered in these handsome volumes. We can readily credit that his chief difficulty in selection has arisen from the superabundance of that material, and the judgment which he has shown leads us to hope that he will continue his laborious but delightful work. His own modest assessment of it, and general abstinence from theorising, will secure him readier hearing for that which is added as comments upon, and conclusions from, the data presented. Mr. Clouston feels his way wisely, therefore cautiously, but, in so far as theories of the *origines* of folk-tales lead him, he inclines to the school of Benfey and Cosquin, which contends that for the most part those tales arose in, and were diffused from, India. We are as yet a very long way from the last word on this matter. Story-telling thrives in the East, but it also thrives wherever man has risen to the social state. Moreover, if we assume that the great body of folk-tale common to the Indo-European races has its source in the old Aryan home, we must remember that scholars are not agreed as to whether that home was in Europe or Asia. Neither can we tell how many older and foreign tributaries mingled with the main stream of grotesque fancy and uncultured imagination which fertilised the highways of human life in a pre-historic past. In considering this question, two things have to be borne in mind, one general, the other special, in its application. We find races at corresponding levels of culture explaining like phenomena in much the same way, and thus we may account for parallel lines of thought and striking resemblance in the myths and legends of races between whom no intercourse has been possible for unnumbered centuries, and we should therefore differ from Mr. Clouston in his exception of many tales even of common life, allowing for local differences, from this explanation. As to the special bearings of the question, let it not be forgotten that the Eurasian continent was peopled with races in no mean stage of culture long before Aryan and Semite attained historic prominence. It is on this older culture, which obtrudes or overlaps in many a persistent type of race and many an archaic belief, that the higher civilisation rests. Rich veins await the smelting fire of sober inquiry which shall extract the secret of their deposit, and to this work the efforts of students of human progress will, we feel persuaded, be increasingly directed. But we must not take leave of Mr. Clouston after this inadequate notice without heartily commending his volumes to the attention of all such workers, as also to a wider class, for the feast of good stories therein.

The Geological and Geographical Distribution of Animals. By Professor Angelo Heilprin. (Kegan Paul, Trench & Co.)—In this newest addition to the well-known International Scientific Series we have an excellent compendium of the facts of past and present distribution of animal life. The principles and phenomena of this distribution have received copious exposition in the important works of Wallace, Sclater, and other authorities, but science knows no finality, and Professor Heilprin has embodied enough fresh material to render his book welcome and opportune. He has made some essential alterations in the arrangement of the great zoological regions into which naturalists commonly divide the land area of the globe, and his book is enriched by an interesting discussion on the origin of the pelagic or deep sea fauna as the modified descendants of primary shore fauna. The important light thrown upon the theory of derivation by a study of the conditions determining the distribution of life is familiar to students of Mr. Darwin's works—in fact, as is well known, it was the observation of the fauna of the Galapagos Islands as compared with that of South America, the nearest mainland, which gave so great an impetus to his investigations.

Through the Fields with Linnæus. By Mrs. Florence Caddy. (Longmans.)—The title of this book led us to expect a ramble by flowery meads, whereas it turns out to be a prosy and padded account of the career of the great botanist. It is difficult to see for what class of readers Mrs. Caddy is catering, since her book is too tedious to interest the general reader, and too flimsy to be of service to students of the science in which Linnæus holds foremost place.

Woodland Tales. By Julius Stinde. Translated by Ellis Wright. (Fisher Unwin.)—The issue of this smooth and pleasant translation of Dr. Stinde's short sketches is probably due to the enormous success of his "Buchholz Family." But though his sketches are short, they are not slight; the workmanship in each is thorough, the subjects are all more or less touching, sometimes, as in "Brother Johannis," bordering on the terrible. The sombre scenery of the forest invests them; the weirdness and pathos of forest-life informs them; and the novel-reader, bored with the small talk and tedious analysis of much of the stuff which Mudie sends him, should read these "Woodland Tales" with fresh appetite.

Sonnets Round the Coast. By H. D. Rawnsley. (Swan Sonnenschein & Co.)—In these poetic seascapes Mr. Rawnsley has skilfully avoided the risk of monotonous treatment of that perilous subject—descriptions of the ocean—by availing himself of the rich significance of material which fringes our coast in historic relic of abbey, shrine, and grave; as well as of the equally suggestive material supplied by quaint tradition and heroic deed. The sonnets betoken a cultured mind, and are marked both by vigour and freshness of thought, as well as by grace of expression; notably so in those which have certain aspects of nature for their theme.

The Perfect Way; or, The Finding of Christ. By Anna B. Kingsford, M.D., and Edward Maitland, B.A. (Field & Tuer.)—This book is printed in type of remarkable beauty, and altogether produced in a style "regardless of expense." But what meaning may lie in it, if there be one at all, only astral spirits, such as the authors claim to possess, may fathom. To our terrene and unillumined mind it is a farrago of cabbalistic rodomontade.

A Concise History of England and the English People. By the Rev. Sir G. W. Cox, Bart., M.A. (London: Joseph Hughes. 1887.)—Admitting to the full the modest allegation in Sir George Cox's preface that "a history of England given in a few hundred pages must necessarily be a sketch," we must, in common fairness, add that he has shown how, in such a sketch, a large amount of really valuable historical information may be conveyed in a lucid and very readable form. A leading characteristic in his treatment of the events he describes, is his fairness and impartiality. Comparatively few clergymen, we venture to think, could be found to narrate the events of the reign of Charles I. in so absolutely calm and judicial a spirit as our author has done. He has produced a work of real value to the incipient student of the history of his own country.

The Making of New England. By Samuel Adams Drake. (London: T. Fisher Unwin. 1886.)—In a very simple, but not on that account less interesting manner, Mr. Drake, who is an American, tells the story of the colonisation of his native land, from the time of its discovery by Sebastian Cabot down to the date of the Confederacy of 1643. Copiously illustrated with maps, plans, views of localities, and engravings of people and objects of archæological interest, this volume may be read with profit and advantage by all who care to learn how slowly and painfully New England was peopled from the Old Country, and in what humble beginnings the vast American Republic had its origin. So far the tale has never been better told for educational purposes.

Joint Scientific Papers of James Prescott Joule, D.C.L., LL.D., F.R.S. Vol. II. (London: Taylor & Francis. 1887.)—Three years ago (Knowledge, Vol. V., p. 245) we reviewed in these columns the first part of the noble contribution made to the advancement of science by the Physical Society of London in the shape of their reprint of the scientific papers of our immortal physicist, James Prescott Joule. As we write, the second volume lies before us. In it we find the details of Joule's experiments on the mechanical powers of electro-magnetism, steam, and horses, made ostensibly in conjunction with Dr. Scoresby, but practically performed by Joule himself; his investigations, conducted with the aid of Sir Lyon Playfair, on atomic volume and specific gravity; and a mass of other researches, chemical and thermo-dynamical, the latter performed with the co-operation of Sir Wm. Thomson. Nothing is more striking than the absolute thoroughness of all Joule's work. It was this very thoroughness, and the scientific conscientiousness of its author, which established its results on so irrefragable a basis and marked so very notable an epoch in the progress of physical science. These volumes will always possess an interest, as embodying the details of the researches of one of the most able and remarkable scientific men of the present century, and one who was in the truest sense of the word an epoch-maker in physics.

Geography made Easy. By John Gibson, M.A. Third Edition. (London: Relfe Brothers.) *Public Examination Scripture Manuals—St. Matthew's Gospel, St. Mark's Gospel.* By Arthur Riches, F.R.A.S., F.R.G.S. (London: Relfe Brothers.) *The Musician: a Guide for Pianoforte Students.* By Ridley Prentice. Grade VI. (London: Swan Sonnenschein & Co. 1887.)—These are three educational works, each carefully and thoroughly done, and suited to the wants of the students whom they address. In the case of Mr. Prentice's work, such students must, however, be very advanced ones.

Home Rule "Wrinkles" for Ladies. By Aunt Betsy. (London: Swan Sonnenschein, Lowrey & Co. 1887.)—In this tiny manual "Aunt Betsy" gives a variety of very useful hints indeed to young wives, mothers, and housekeepers. Its trivial cost places it within the reach of all such, and is out of all proportion to the real value of its contents.

Easy Guide to the Principal Constellations and Stars visible in Great Britain. By E. W. (London: Griffith, Farran, Okeden & Welsh.)—This cheap little sheet forms a capital primer for familiarising the very beginner with the face of our English night sky. It is very well done, and will be found really useful by those who wish to learn the chief stars visible in this country.

The Artist's Manual of Pigments. By H. C. Standage. Second Edition, revised. (London: Crosby Lockwood & Co. 1887.)—The commendation we bestowed upon the first edition of Mr. Standage's valuable practical work (Knowledge, vol. ix. p. 259) may be unhesitatingly extended to it in its revised and improved form. No painter's library can be held to be complete without it.

Suggestive Lessons in Practical Life. Fourth Series. (Smith & Elder.)—This volume completes a very useful series, and we are happy to extend to it the unqualified praise given to its predecessors. We have received from the same publishers Volume X. of the *Dictionary of National Biography*, on the rapid progress of which spirited undertaking we congratulate them. We have also to acknowledge a new volume of the "Book Lover's Library"; *The Dedication of Books*, by H. B. Wheatley (Elliot Stock), with its choice selection of some famous ancient and modern dedications, from Shakespeare downwards, to friends and patrons; *Immodesty in Art, a Letter to Sir Frederick Leighton*, by Rev. F. G. Lee, to whom we may commend Browning's "Parleyings" with Francis Furini; *Babies' Crawling Rugs, and How to Make Them*, by E. S. Windsor (Griffith & Farran)—homely and practical; *Jackson's Vertical Writing Copy Books* (Sampson Low & Co.)—a good idea well carried out; Part II. of the *Smithsonian Report*, 1884; *The American Naturalist*, in which is the opening paper of what promises to be a valuable series on the "Significance of Sex." Of papers in the current number of the *Century Magazine* everybody will read Mark Twain's amusing but humiliating paper on "English as She is Taught," and the discerning few will not skip Professor Whitney's article on the "Veda." *St. Nicholas* is up to its high average, and in *Longman's* Mr. Rider Haggard keeps us at fever heat as to the fate of Allan Quatermain and his co-adventurers, while Mr. Louis Stevenson gives a delightful sketch of an old Highland shepherd.

We have also on our table Dr. Richardson's *Asclepiad* (London: Longmans & Co.), with an excellent article of great popular interest on "Natural Selection for Science and for Art." *The Medico-Legal Journal*, New York. *The Journal of the National Fish Culture Association* (London: The Blackfriars Printing and Publishing Company, 1887), interesting to all concerned in the development of an almost unlimited source of valuable food. *Practical Hints on House Drainage* (London: The Scientific Publishing Company, 1887), useful to householders when sanitary arrangements are in any way defective; and the *Report of the Papers read and Discussions* at the Conference of the Camera Club (same publishers).

Our Chess Column.

By "Mephisto."

INTERNATIONAL CHESS CONGRESS.

THE programme has been issued of the fifth biannual Congress of the German Chess Association, which will assemble at Frankfurt on July 17. There will be plenty of attractions in the shape of various minor tournaments for those amateurs who may wish to make the Congress an excuse for spending their holidays on the Rhine. The principal event, however, will be the International Masters' Tournament. The prizes are 50*l.*, 37*l.* 10*s.*, 25*l.*, 15*l.*, 10*l.*, 7*l.* 10*s.* Conditions are, as usual, twenty moves an hour, play from nine till one and four till eight, three games to be played in two days, each player to play with every other, drawn games to count half, &c. There is also a prize of 5*l.* for the most brilliant game, generously given by Mr. F. H. Lewis.

I venture to predict that this tournament will prove a greater success than any former meeting. There are various causes which will bring this about, despite the fact that the prizes are small when compared with those given by the British Chess Association. If I may make use of a paradoxical assertion, I would say it is nearer for Englishmen to go from London to Frankfurt than it is for Germans to travel from Frankfurt to London. Frankfurt is centrally situated, and living there being cheap, many of the strong Viennese players will, no doubt, attend. Others, again, will go for the purpose of enjoying a holiday. But, in reviewing the chess masters of the day before our mind's eye, we have no doubt that there will be at least two of the young players in Berlin who will join the masters. The probabilities are that Herr von Bardeleben, of Berlin, and M. Tschigorin, of St. Petersburg—two players of the highest order—who did not compete on the last occasion at Hamburg, in 1885, may do so now. We may predict with certainty that M. Taubenhaus, from Paris, will participate, and, according to all accounts, he as well as the other rising players mentioned have greatly improved, and will make a stout attempt to wrest the laurels from the older and more experienced masters, the same as Gunsberg succeeded in doing in '85 at Hamburg. We hope to welcome another fresh chess competitor at these tournaments in Mr. Lipshutz, from New York, who made his first successful début at the B. C. A. meeting in London last year. England, if we are not mistaken, will also send her usual contingent of players, reinforced this time probably by Pollock and Burn, both players of high merit, who did not compete in any former masters' tournament in Germany. Zukertort may perhaps be induced to take part, for the simple reason that, where there is such a plethora of chess talent, a true chess-player will naturally be disinclined to allow himself to be excluded by mere monetary considerations. All these probabilities favour the assumption that the Chess Congress at Frankfurt will be a great success.

"THE CHESS PROBLEM."*

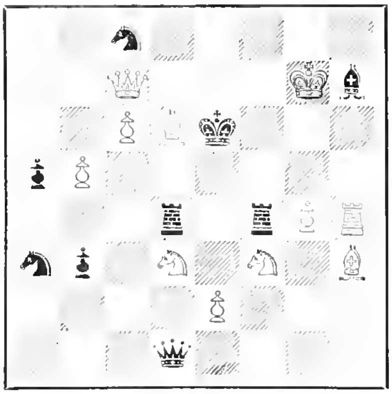
Of chess-books written in the English language it may well be said that many that are written are not desired, and a few that are desired are not written. The book before us is eminently a desirable work. It contains 400 problems, comprising 2, 3, 4, and 5 movers, suimates, and prize problems, the composition of the four eminent English problemists mentioned above. These form a valuable collection of fine problems, alike interesting to the lovers of problems

* Text-book with Illustrations containing Four Hundred Problems selected from the works of H. J. C. Andrews, E. N. Frankenstein, B. G. Laws, and C. Planck. Cassell & Company, Limited, London.

and instructive to composers. To this collection is added a treatise teaching how to make problems, and consequently how to achieve fame. In the words of the authors:—"Hitherto no chess work explanatory of the problem art has issued from the home press. . . . The essay contained in these pages, although emanating from the pen of Mr. Planck, has, after discussion and modification, received the assent of his colleagues, and may therefore be considered as representing the well-digested conclusions of four trained minds upon the most important questions relating to the chess problem in its modern form." We hope that no problemist will omit to obtain these "well-digested conclusions," for well-digested conclusions are in one respect similar to malted food (so ably explained by Mr. Mattieu Williams)—they are both easily assimilated. Appended are four examples taken from the book, from which it will be seen what a great amount of enjoyment may be derived from possessing these 400 brilliant chess problems:—

By H. J. C. ANDREWS.

BLACK.



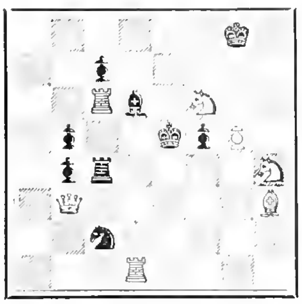
WHITE.

Mate in three.

1. B to R8.

By E. W. FRANKENSTEIN.

BLACK.



WHITE.

Mate in two.

1. R to Q4.

By B. G. LAWS.

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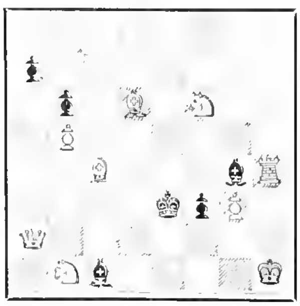


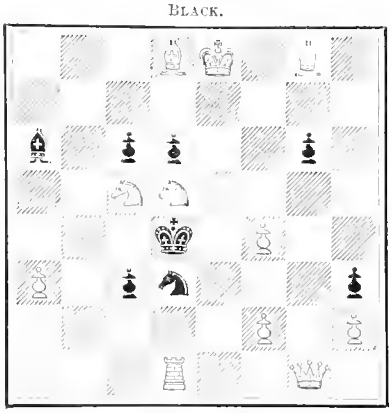
WHITE.

Mate in two.

1. Q to R5.

By C. PLANCK.

BLACK.



WHITE.

Mate in three.

1. Q × P.

In connection with the above we have to make the melancholy announcement of the death of Mr. H. J. C. Andrews, which occurred recently. Mr. Andrews was an exceptionally-gifted problem composer, whose experience extended over forty years of work and gratuitous labour for the sake of chess. His death has called forth universal expressions of regret and esteem.

THE following game was recently played in a Handicap Tournament at the British Chess Club:—

WHITE. J. H. Zukertort.	BLACK. J. Gunsberg.
1. P to Q4	P to Q4
2. Kt to KB3	P to K3
3. P to K3	Kt to KB3
4. B to Q3	P to B4
5. P to QKt3	Kt to B3
6. B to Kt2	P × P
(An undesirable capture.)	
7. P × P	B to Q3
8. Castles	Castles
9. P to B4	P × P
10. P × P	P to QKt3
11. QKt to Q2	B to Kt2
12. R to Bsq	B to B5
(Early aggression. R to Bsq was good.)	
13. P to Kt3	Kt to QKt5
(Looks showy, but results in loss of time, as the Kt has to retreat presently.)	
14. B to K2	B to R3 !
15. Q to R4 !	Kt to R3 ?
(B × KKt, or Kt to B3 is better—leaves Black with a well-developed position.)	
16. KR to Qsq	Kt to Ktsq ?
(Lamentable delusion.)	
17. Kt to K5	Kt to K5
(Missing another chance by B × Kt. 18. R × B, Kt to K5. 19. R to Qsq, Kt to Kt4, &c.)	
18. P to B4	P to B3
19. Kt to Kt4	Kt × Kt
20. R × Kt	Kt to Q2
21. Q to Kt3	Kt to B4
(Again results in loss of time.)	
22. Q to K3	Kt to K5
23. KR to Qsq	R to Ksq
24. B to B3	Kt to Q3
(White has got his Q and R better posted.)	
25. Kt × B (ch)	P × Kt
26. B to R5	Kt × P.

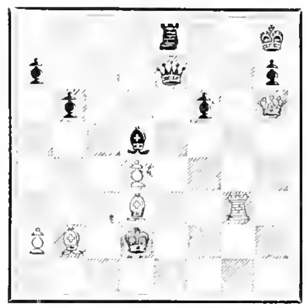
BLACK.

WHITE.

(Making a virtue out of the necessity to escape from a bad position.)

WHITE. J. H. Zukertort.	BLACK. J. Gunsberg.
27. R × Kt	Q to Q4
28. Q to K2	KR to QBsq
(Unfortunately for Black, White can check with his Q on Kt4, whereby he escapes the consequences of B to R3.)	
29. KR to QBsq	R × R
30. R × R	Q to R8 (ch)
31. K to B2	Q × P (ch)
32. K to Ksq	Q × P (ch)
33. Q to B2	Q to R6
34. B to K2	B to Q4
(Necessary to stop the uncovering of the B by P to Q5.)	
35. R to B7	K to Rsq
36. K to Q2	R to KKtsq
37. R to B3	Q to B4
(The choice lay between this move and Q to R8.)	
38. R to KKt3	R to QBsq
39. B to Q3	Q to R4
40. P to B5 !	P × P
41. B × P	R to KBsq
42. B to Q3	Q to B2 ?
43. Q to B4	R to Ksq
44. Q × RP	Q to K2

BLACK.



WHITE.

45. R to K3	Q × R (ch)
46. Q × Q	R × Q
47. K × R	B × P
(The game is lost, but it was wrong to take this P as the B thereby gets quite out of play.)	
48. B to K4	K to Ktsq
49. P to Q5	P to B4
(Unnecessary.)	
50. B to B3	K to B2
51. K to B4	K to K2
52. K × P	P to R4
53. K to K5	P to Kt4
54. P to Q6 (ch)	K to Qsq
55. B to Q4, and White won.	

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Our Whist Column.

By "Five of Clubs."

MATHEWS ON WHIST.

(*Continued from p. 120.*)

Leading Trumps.

[It remains that the question of leading trumps should be considered.]

It is difficult to judge when to lead trumps. The following situations will assist the beginner to reason, and in general direct him properly [though they do not include all the cases in which it is generally proper to lead trumps]:—

1. With six trumps, on the supposition that your partner has a strong suit.
2. If you are strong in other suits, though weak in trumps.
3. If your adversaries open weak suits.
4. If your adversaries have scored three,* and you have no honour, or probability of making a trump by a ruff.

[In the fourth case, the lead of trumps is good for the reason that, unless your partner is strong in them, the game is probably lost, and if he is strong in them, you do well to lead them to him.]

[Mathews says specially that unless you have six trumps you should not lead trumps, unless either you or your partner have a strong suit. Modern play recognise five trumps, with or without strength in your own hand, as usually affording sufficient reason for a trump lead—except when you are playing for the odd trick, when it is generally well to wait before leading trumps, to see whether the required tricks may not be more safely secured by a ruffing game.]

In playing for an odd trick, you play a closer game than at other scores. You lead from single cards [modern Whist rejects this], and force your partner, when at other times such a course would not be justified [that is, even when you have reason to think he has length in trumps]. Hence it is seldom proper in this case to lead trumps.

[I must, however, take this occasion to note that the rule often laid down that you should refrain from leading trumps when you require but the odd trick would not be regarded as always to be followed. The very circumstance that by leading trumps the chance of securing the odd trick through a ruff or two may often be lost, shows that by leading trumps you may often deprive the enemy of the chance of making the odd trick by ruffing; and if you prevent the enemy from making the odd trick you commonly secure it for yourself and partner.]

Do not lead trumps merely because an honour is turned up on your left, nor be deterred from leading trumps because an honour is turned on your right hand. Either lead is proper if the circumstances of your hand require a trump lead; but neither otherwise. [Mathews's dictum is a little too positive. There can be nothing much more absurd than the practices he deprecates—that is, leading or refraining from leading trumps because of an honour turned up to left or right; yet the fact that an honour certainly lies on your left may make a trump lead, otherwise inexpedient, permissible, while an honour certainly on your right may make an otherwise expedient trump lead undesirable. The known position of an honour must be taken into account, and dealt with for what it may be worth.] There is a certain advantage in leading through an honour, as Mathews himself shows, by noting that "it is as advantageous to lead up to as through an Ace: not so advantageous to lead up to a King as up to an Ace: and disadvantageous to lead up to a Queen."] [Note, also, that the trump card may cause a deviation from the general rules for leading. Thus, if the trump leader holds Ace, King, ten, nine, with or without others, and the Queen or Knave was turned on his left, he would do well to lead the lowest of the ten, nine, sequence. If the honour is put on, he has at the next round a finesse against but one card. On the other hand, such a lead would be absurd if the Queen or Knave had been turned on the right.]

If you have the trump Ace, and the circumstances of your hand require two certain leads in trumps, lead the Ace, let the other trumps be what they may. [Be careful about the circumstances, however.] [*Per contra*, if the adversaries lead trumps, and you hold Ace and one or two others, put on the Ace at once; but] with the Ace and three other trumps, it is seldom right to win the first or second trick, unless your partner ruffs some other [when you put on your Ace to give him a ruff].

If you have Ace, King, and two more trumps, and your partner leads them originally, insure three rounds in trumps: but if he lead (in consequence of your showing your strength) a nine or any equivocal card, pass it the first time: by this you have the lead after three rounds of trumps—a most material advantage.

When with a very strong suit you lead trumps, hoping your partner may command them, show your suit first. But if you have strength in trumps in your hand, lead trumps first. With only four trumps, do not lead one unless your strong suit is established. With tierce major and another trump, however, and a sequence of three or more to the King, it is well to lead trumps twice, and then the Knave [or lowest of the head sequence] of your suit, continuing till the Ace is out. [It is only advisable, however, to lead the lowest of the head sequence in the plain suit, when you hold five cards or more in it.]

Play Second Hand.

There are points where good players disagree. Some play what is called a forward, others a more timid game. Some commonly put on a king second, others but rarely. In these cases a man may play either way without committing error, but where all good players are of the same opinion it should be received as an axiom. No good player puts on a Queen, Knave, or ten second: of course, this should be on all occasions carefully avoided. [It seems clear that though Mathews includes the case of the Queen, Knave, or ten with but one small one, he is here speaking generally, as in dealing with the play of King second hand. It would appear that in his day for play second hand the old-fashioned rule, "King ever, Queen never," was held as a general rule, where it was held at all. Nowadays, except where a smaller honour is led, no one thinks of putting on King, Queen, or Knave second hand, if holding two or more small cards. Nor does any recognised whist authority now sanction the play of King, Queen, or Knave second hand when there is but one small card except when a lead is specially wanted.] On this point Mathews deals specially elsewhere, saying, with King and one more good players sometimes put on King second, sometimes not. If it is the trump card it should invariably be put on [this is no longer held], and generally it is good to play King, from King one other, in trumps. [This held till Clay's time, but is now discountenanced.] Queen or Knave should never be played [from Queen or Knave, one other], except in trumps, when a superior honour has been turned up on the right. It is interesting to notice thus how early the rule now accepted by all good players was recognised by skilful whist strategists as sound.

With Ace, Queen, ten of your right-hand adversary's lead, put on the ten. [The modern rule is, the ten in trumps, the Queen in plain suits.] With Ace, Queen, and others, not including the ten, put on a small one, unless he leads the Knave in which case put on the Ace invariably. No good player with King, Knave, and ten will begin with the Knave; so that of course it is finessing against yourself to put on the Queen, as the King is certainly behind you. If fourth player holds it you give away at least the lead, and in any case can secure no possible advantage.

With King, Queen, &c., of your right-hand adversary's lead, put on one of them [the Queen unless you wish to deceive all round]; with Queen, Knave, and another, the Knave; with two or more small ones, the lowest. [Modern play enjoins the ten from Knave, ten, and another; some add the nine from ten and another; but that is running it rather close: the chance of helping fourth player is not equal to the chance of mischievously misleading him.]

With only three of a suit, put an honour on an honour, with four play your lowest. But the Ace should always be put on the Knave. [In Bohn's edition of Mathews, he is made to say "except the Ace should not be put on the Knave:" but the context, and what he says elsewhere, agree in showing that he said, or intended to say, here, the Ace should be put on the Knave second hand, even if you hold four in the suit.

If your right-hand adversary has led, and, his partner putting on Knave or Queen, your partner wins with the King—should a [small] card of that suit be again led on your right, if you have the ten put it on. It is probable that by doing this you keep the commanding card in your partner's hand, and prevent the second best from making.

NOTE ON THE CALL FOR TRUMPS.

In the good old days of Hoyle and Mathews unnecessarily high cards were not unfrequently played. But they were not played to inform partner. The old players would probably have included any practice of the sort among the offences contemptuously classed in their time as "Piping at Whisk." What Hoyle or Mathews would have said by the way, of the not uncommon extension of the signalling system where a partner hesitates before playing a small card to his partner's Ace or King lead, with the idea of either forcing his attention to the signal, or of showing (as the case may be) that though very strong, he is not *quite* strong enough to signal,

* Mathews, who deals with long whist, says here, of course, "if your adversaries are at the point of *eight*," but the same rule would guide in short whist, when they have scored three.

we can hardly say. Probably, like our "Pembridge"* to-day, they would have found ordinary words too weak to express their contempt and abhorrence of all such practices. But, as I have said, in their day unnecessarily high cards were played—*always*, however, as false cards to delude the enemy. An opponent is making his high cards in a suit of which a player holds, say, ten and three: if the ten is played, the opponent naturally expects to see the suit ruffed next round or early; and as naturally, he will discontinue the strong suit (unless the strategy of his game makes it desirable that he should play for a force), and probably lead trumps. The partner of the player, who has thus dropped an unnecessarily high card, will infer that the trump lead is wanted; and if the enemy fail to be deceived by the false card, he will lead trumps himself. In that sense, but in that sense only, the unnecessarily high card in Hoyle's time was, as it were, a call for trumps.

All this belongs to the delightful strategy of whist. There were in such cases several interpretations of the observed play to the particular trick, several inferences suggested by the previous fall of the cards. Neither the enemy nor the partner of the player who had dropped the high card, having a smaller one, could feel quite sure what the play might mean. That pleasing mixture of doubt and confidence—doubt because of the enemy's craft, confidence in the just discrimination skill affords between the probabilities for and against various interpretations—which constitutes the charm of real whist comes in—or, alas! that I should have to change the tense, came in, of yore—to give interest to such a stroke, and to the measures taken either to meet or foil it!

In the whist of to-day, which is calmly described by the professors of the signalling system as scientific whist, as if the whist of Hoyle and Mathews (far more soundly scientific in reality) were child's play, the unnecessarily high card does not involve any whist interest whatever. It means one thing, and one thing only. It is a command to partner to lead trumps.

* It was Pembridge who brought into use, if he did not actually invent, the pleasing word "Bumblepuppy," as the name for that kind of whist which the constant follower of conventions is in the habit of playing; as Bumbledom has found a place in dictionaries written since "Oliver Twist" appeared, I conceive that Bumblepuppy ought soon to be similarly authenticated.

THE FACE OF THE SKY FOR MAY.

THE sun is now so free from spots for days and even weeks at a time as to render a daily watch for them almost a waste of time. There is no real night in any part of Great Britain after the 22nd, twilight persisting from sunset to sunrise. The aspect of the night sky will be found depicted in map v. of "The Stars in their Seasons." No minima of Algol will, practically, be visible throughout the month. The best chance for the observer to detect Mercury will be before sunrise at the beginning of May. Venus is an evening star, shining most brilliantly at dusk over the W. by N. and W.N.W. parts of the horizon. At the end of the month she does not set until between eleven and twelve o'clock at night. She is gibbous in the telescope. She will be 2° 15′ north of Saturn at 5 P.M. on the 30th. Mars is totally invisible. Jupiter is above the horizon all night long, but, having south declination, should be observed as near to his time of meridian transit as possible. He is travelling through Virgo towards Spica. ("The Stars in their Seasons," map v.) The observable phenomena of his satellites occurring at convenient hours are tolerably numerous. On the 3rd, Satellite III. will begin its transit at 9h. 30m., followed by its shadow an hour later. The satellite will leave the planet's opposite limb at 11h. 5m. P.M., and its shadow twenty-nine minutes after midnight. On the 5th, Satellite II. will be occulted at 9h. 55m. P.M. On the 6th, the transit of Satellite I. will begin at 10h. 25m P.M., and that of its shadow at 10h. 47m. At 12h. 37m the satellite will pass off Jupiter's face, as will the shadow it casts at 12h. 59m. On the 7th, Satellite I. will reappear from eclipse at 10h. 13m. 14s. P.M. On the 10th, Satellite III. will enter on to the planet's limb at forty-seven minutes after midnight. On the 12th, Satellite II. will be occulted at 12h. 12m. P.M. On the 13th, Satellite I. will begin its transit ten minutes after midnight, as will its shadow thirty-one minutes later. On the 14th, Satellite I. will be occulted at 9h. 25m. P.M. One minute later Satellite II. will pass off Jupiter's disc, its shadow following at 10h. 34m. Satellite I. will reappear from eclipse at 12h. 7m. 16s. P.M. On the 15th, the egress of the same satellite from Jupiter's limb will happen at 8h. 48m. P.M., its shadow following at 9h. 22m. On the 21st the ingress of Satellite II. in transit occurs at 9h. 9m. P.M.; then Satellite III. will reappear from eclipse at 10h. 28m. 55s. At 10h. 33m the shadow of Satellite II. will follow it on to Jupiter's limb; at 11h. 10m. Satellite I. will be occulted; and at 11h. 42m. Satellite II. will have left the face of the planet. On the 22nd the ingress of the shadow of Satellite I. happens at 9h. 5m P.M., and the egress from the opposite limb of the satellite casting it at 10h. 35m. The shadow does not quit Jupiter's face until 11h. 17m. On the 28th Satellite III. will be occulted, disappearing at 9h. 21m. P.M., and not reappearing until 11h. 14m. Then Satellite II begins its transit at 11h. 26m.; Satellite III. disappears in eclipse at 12h. 44m. 44s., and Satellite I. is occulted at 12h. 57m. On the 29th Satellite I. began its transit at 10h. 10m. P.M., followed by its shadow at 11h. The satellite leaves Jupiter's opposite limb at 12h. 22m.; the shadow not until the next morning. Lastly, on the night of the 30th, Satellite II. will reappear from eclipse at 10h. 17m. 19s; as will Satellite I. at 10h. 24m. 12s. Saturn is now approaching the west, and must be looked for the moment the sky is dark enough, even at the beginning of May. He is pretty close to δ Geminorum ("The Stars in their Seasons," map ii.). Uranus is about south at sunset, so like Saturn must be looked for as soon as ever the twilight deepens. He is S.W. of γ Virginis ("The Stars in their Seasons," map v.). The Moon is full at 2h. 13m. P.M. on the 7th, and enters her last quarter at 8h. 17·4m. P.M. on the 14th; she is new at 11h. 5·4m. on the 22nd; and enters her first quarter at 5h. 19·7m. A.M. on the 30th. Four occultations only of fixed stars occur at convenient hours during the May nights. They are as follows:—On the 4th γ^1 Virginis, a star of the $2\frac{1}{2}$th magnitude, will disappear at the Moon's dark limb at 25 minutes after midnight at an angle of 141° from her vertex. It will reappear the next morning at 1h. 8m. at her bright limb at a vertical angle of 230°. Then, on the 29th, 45 Leonis, a 6th magnitude star, will disappear at the dark limb at 8h. 37m. P.M., at an angle of 69° from the vertex of the Moon, its reappearance at her bright limb happening at 9h. 34m., at an angle of 314° from her vertex. Later, at 11h. 10m. P.M., ρ Leonis, a star of the 4th magnitude, will disappear at the dark limb at a vertical angle of 88°. It will reappear at her bright limb at 2 minutes after midnight, at an angle from her vertex of 311°. Lastly, on the 30th, σ Leonis, also of the 4th magnitude, will disappear at the dark limb at 7h. 46m. P.M., at an angle of 152° from the Moon's vertex, its reappearance at the bright limb occurring at 8h. 6m. at a vertical angle of 188°. When these notes begin, the Moon has just entered on the confines of Leo ("The Seasons Pictured," plate xxiv.), through the whole length of which constellation she is travelling until 10h. P.M. on the 3rd, at which hour she enters Virgo ("The Seasons Pictured," plate xxv.). Her passage across Virgo occupies her until 6h. 30m. P.M. on the 6th, and she then crosses into Libra ("The Seasons Pictured," plate xxvi.). Travelling over Libra, she arrives at noon on the 8th on the boundary of the narrow northern spike which runs up from Scorpio, and when, by 9h. o'clock the same evening she has crossed this, it is to emerge in Ophiuchus. At 11 A.M. on the 10th, she quits Ophiuchus for Sagittarius, which she leaves in turn for Capricornus at 8h. 30m. P.M. on the 12th ("The Seasons Pictured," plate xxi.) Her journey over Capricornus is completed by 4 A.M. on the 14th, when she enters Aquarius. She continues in Aquarius until 4h. A.M. on the 17th. She then crosses into Pisces ("The Seasons Pictured," plate xxii.). She remains in this great straggling constellation until 8h. A.M. on the 20th, and then arrives on the confines of the northerly prolongation of Cetus. By 10 o'clock the same night she has gone through this and come out in Aries ("The Seasons Pictured," plate xxiii.). She is in Aries up to 2h. 30m. A.M. on the 22nd, when she enters Taurus. Pursuing her path through Taurus, we find her at 9h. 30m. P.M. on the 24th on the boundary of the most northerly part of Orion. Twelve hours later she has crossed this and emerged in Gemini ("The Seasons Pictured," plate xxiv.). Her passage over Gemini terminates at 3h. A.M. on the 27th, when she leaves it for Cancer. She quits Cancer in turn for Leo, at 4h. P.M. on the 28th. She is in Leo up to 5 A.M. on the 31st, and she then crosses the boundary into Virgo. She is still in Virgo at midnight on the 31st.

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SHAKESPEARE'S POEMS.

THOUGH I do not propose here to discuss the Baconian paradox, I touch upon it as giving interest to certain comparisons which I am about to make between the poems of Shakespeare and his plays. Even the most rabid Baconian, I imagine, does not deny that Shakespeare wrote "Venus and Adonis," "Lucrece," the Sonnets, the "Lover's Complaint," and parts of the "Passionate Pilgrim" (really a congeries of short poems, some of which were admittedly his, while others were as certainly the work of other men). Of course, the circumstance that in "Love's Labour Lost" some of these poems are actually introduced, would in no sort convince a paradoxist that the play was not Bacon's: for it is one of the charming characteristics of paradox that it can derive comfort from the most contradictory arguments. If we find a passage in Shakespeare which suggests Baconian thoughts, then we are asked, "Who but Bacon could have written that?" But if we find something which Bacon could not be supposed to have written, or, as in the present case, something which Shakespeare certainly wrote, then we are asked to admire the ingenuity with which Bacon masked his identity. Therefore I do not insist on the circumstance that, unless Bacon was a thief or Shakespeare a rogue (or preferably both), the appearance of unquestionably Shakespearean sonnets in one of Shakespeare's plays suffices to overthrow the Baconian theory. (In fact, who *wants* to overthrow it?—any more than a grown man would want to kick over the mud fortresses or the oyster grottoes of little children.) But the evidence of the Shakespearean mind, and especially of Shakespeare's specially dramatic power, shown in the poems which he certainly wrote, is well worth studying apart from any such fond fancies in regard to the plays. Nay, I may go so far as to admit that if some of the Baconian paradoxists should be led to study Shakespeare's poems (it is hopeless to urge them to study appreciatively Bacon's "Instauratio Magna" and "Novum Organum") this little essay would have served a useful purpose.

"Venus and Adonis" was probably written several years before 1593, when it was published. Shakespeare speaks of it as "the first heir of his invention," and it is certain that he had written other poems than this before 1593, for Spenser, in 1591, had praised Shakespeare's muse, "full of high thoughts' invention." It is thought by some that Shakespeare wrote this poem before he came to London—somewhere about 1586—but I imagine he had not much opportunity for poetic composition during the few years which he passed at Stratford after his much too early marriage (to a woman eight years his senior). Some of the softer touches of the wooing of Adonis by Venus may without malice be thought to have been memories of Ann Hathaway's wooing of the young poet, for when a woman of twenty-six, even the most charming, is wed too early, yet too late, by a boy of eighteen, one may usually suppose the woman the first to woo. And even in the coldness of Adonis the poet may have pictured in part his own boyish bashfulness, as where in the first sonnet of "The Passionate Pilgrim" he says:—

> But whether unripe years did want conceit,
> Or he refus'd to take her figur'd proffer,
> The tender nibbler would not touch the bait,
> But smile and jest at every tender offer.

The love of Phœbe for Rosalind in her disguise as the boy Ganymede suggests similar thoughts, though we must not profanely touch the Shakespearean drama, where Shakespeare the man scarce ever shows, but only Shakespeare the inspired creator of men.

The "Venus and Adonis," if marked by many faults, and painted throughout in too warm tints, yet contains clear evidence of the work of the Shakespeare of the plays. Here and there occur words and phrases, such as Shakespeare has elsewhere used almost unchanged. Thus, reproaching Adonis: "Ah, me!" quoth Venus, "young and so unkind"; as Lear to Cordelia: "So young and so untender." The descriptions, especially of animals, are such as are matched only in the plays. Consider, for instance, the description of the horse:—

> Look, when a painter would surpass the life,
> In limning out a well-proportion'd steed,
> His art with nature's workmanship at strife,
> As if the dead the living should exceed;
> So did this horse excel a common one,
> In shape and courage, colour, pace, and bone.
>
> Round-hoof'd, short-jointed, fetlocks shag and long,
> Broad breast, full eye, small head, and nostrils wide,
> High crest, short ears, straight legs, and passing strong,
> Thin mane, thick tail, broad buttock, tender hide.
> Look, what a horse should have he did not lack,
> Save a proud rider on so proud a back.

One may recognise the country-bred poet in the description of hunting sports, both of the more dangerous sort as in the boar hunt, and in the hunting of the weak hare:—

> Mark the poor wretch, to over-shoot his troubles,
> How he outruns the winds, and with what care
> He cranks and crosses with a thousand doubles:
> The many musets through the which he goes,
> Are like a labyrinth to amaze his foes.

(Note here and there throughout the poem the ease and grace of diction, the wide vocabulary, and the use of such words as Shakespeare the dramatist is fond of using—as, for instance, "He cranks and crosses," comparing with this Hotspur's remark that this river "comes me cranking in.")

In the following passage we recognise Shakespeare's knowledge of animal ways (is there no paradoxist prepared to recognise some huntsman or veterinary surgeon of Elizabeth's time as the author of the plays?), and in "caitiff," "venom'd," "sovereign" (adjectively), "ill-resounding," "welkin," "volleys," we note the Shakespearean vocabulary:—

> Here kennel'd in a brake she finds a hound,
> And asks the weary caitiff for his master;
> And there another licking of his wounds
> 'Gainst venom'd wounds the only sovereign plaster:
> And here she meets another sadly scowling,
> To whom she speaks, and he replies with howling.
>
> When he hath ceas'd his ill-resounding noise,
> Another flap-mouth'd mourner, black and grim,
> Against the welkin volleys out his voice;
> Another and another answers him.
> Clapping their proud tails to the ground below,
> Shaking their scratch'd ears, bleeding as they go.

Compare with this the talk of Theseus and Hippolyta about hunting ("Midsummer Night's Dream," act iv. scene 1).

The "Lucrece," like "Venus and Adonis," was dedicated to the Earl of Southampton; and here the testimony of this powerful patron of Shakespeare's may be quoted as decisive against the fancy of the Baconian paradoxists, though it would be of no weight with the paradoxists themselves. The man to whom Shakespeare dedicated these poems, who knew at once of Shakespeare's powers and of his life, who must have suspected (if he had not known all about) the imagined compact between Bacon and Shakespeare, by which the ignorant paradoxist strives to blast the fame of both, had so contemptible a compact ever existed, wrote in 1608 to another nobleman, Lord Ellesmere, the Lord Chancellor, that William Shakespeare, his "special friend," "till of late an actor of good account in the company" (he was writing about the Blackfriars Theatre), "now a sharer in the same, and writer of some of our best English plays, which, as your lordship knoweth, were most singularly liked of Queen Elizabeth, when the company was called upon to perform before Her Majesty at court at Christmas and Shrovetide. His most gracious Majesty King James also, since his coming to the crown, has extended his royal favour to the company in divers ways and at divers times." To those who know in what respect nobility was held, and held itself, in the beginning of the seventeenth century, and the almost divine light which surrounded royalty in men's imaginations (Shakespeare presents his worst king as claiming that "divinity doth hedge a king"), the Earl of Southampton's testimony will appear most striking. The very fact that to us the honour is all the other way makes his expressions the more remarkable—free as they are even from the common fault of titled patronage, the offence of condescension. We may be well assured that the man whom, though but a plebeian, he esteemed his friend was known to him as the true author of the works he attributed to him. "Right famous is he," Southampton said of Shakespeare, "in his qualities." Yet the Baconian paradoxist must still believe that Shakespeare was an illiterate, uncultured countryman, ready to be the apt tool of Bacon's scheme—even though the paradoxist cannot tell us what imaginable reason Bacon had for entering on so contemptible a plot, or why, desiring to associate a likely name with his masterly plays, he should have selected a man of whom they say that it is utterly impossible (the extremest form of unlikelihood) that he should have produced even the weakest of them.

The "Lucrece," more than the "Venus," shows touches indicating study of Spenser, especially in the freer use of alliteration. Thus, in verse 8—

> When virtue bragg'd, beauty would blush for shame;
> When beauty boasted blushes, in despite
> Virtue would stain that o'er with silver white.

That Shakespeare could not have admired Spenser's more exaggerated use of alliteration, as in the fearful line, "The sad soothsayer seeing so sad sight" (though he has in "Lucrece" "To see sad sights moves more than hear them told"), we may guess from his jesting use of it in "Henry VIII." in the lines—

> Born by butcher, but by bishop bred,
> How high his haughty highness holds his head.

(The last must have taxed the aspirations of the Londoners if they were as bad in his time as now), and again in the prologue to the "very tragical mirth" of the play presented by Bottom, Quince, Flute, Snout, and Starveling—

> Whereat with blade, with bloody, blameful blade,
> He bravely broached his boiling, bloody breast.

In "Lucrece" the dramatic power of the poet shows itself as well as the descriptive. The soliloquies of Tarquin (there are four), in the longer of which he is Shakespeareanly presented, not as a weaker poet would have shown him, striving to justify the evil he proposes, but urging all reasons which should move him to desist, his words to Lucrece, her appeals to him and his final answer (which closely resembles the threat of Proteus to Sylvia in the "Two Gentlemen of Verona"), all these, though the poet has expanded them more than in a play would have been just, are strictly dramatic in character; and they are such passages as only the creator of Othello and Cymbeline could have produced. Passing over several dramatic passages, we find still more strikingly Shakespearean in dramatic power the closing scene where Lucrece tells her husband and father of the wrong done her. Only a Lucrece pictured by a Shakespeare could speak and plead as Lucrece here. The silence of Collatinus is in itself Shakespearean—

> Which speechless woe of his poor she attendeth,
> And his untimely frenzy thus awaketh:
> Dear lord, thy sorrow to my sorrow lendeth
> Another power; no flood by raining slaketh.
> My woe too sensible thy passion maketh,
> More feeling* painful; let it then suffice
> To drown one woe, one pair of weeping eyes.
> And for my sake—when I might charm thee so—
> For she that was thy Lucrece—now attend me.

(These two last lines are singularly beautiful, and very fine is the sudden change of tone in what follows):—

> Be suddenly revenged on my foe,
> Thine, mine, his own. Suppose thou dost defend me
> From what is past: the help that thou shalt lend me
> Comes all too late, yet let the traitor die;
> For sparing justice feeds iniquity.

Her appeal to the lords standing round to give their promise that the wretch as yet unnamed shall die, her anxious question whether she may acquit herself of blame, is followed at once (when—

> they all at once began to say
> Her body's stain her mind untainted clears)

by Tarquin's name, and the death-stroke, with the dying words (like Æneas' famed *Pallas te hoc vulnere, Pallas immolat*): "He, he, fair lords, 'tis he, that guides this hand to give this wound to me." All this is such as only the Shakespeare of the plays could have produced.

I find I have left no room to touch upon the sonnets as manifesting authorship by the same hand which wrought the plays. I leave them then to another occasion, only noting here further the use in "Lucrece," as in "Venus and Adonis," of words and phrases such as Shakespeare uses in his dramatic works. The "bloody, blameful blade" used jestingly in the "Midsummer Night's Dream" may be compared with the "cursed crimeful night" of Lucrece—even the quaint turn of expression being matched in—

> She sheathed in her harmless breast
> A harmful knife, that thence her soul unsheath'd.

Such strange words as "sneap'd," "rigol," "key-cold," and such expressions as "a barebon'd death," a "comfortable star" (like the "comfortable hour" of Richard III.), attest the common authorship of the plays and poems. But it is in such passages as the description of Lucrece sleeping, and her impassioned outcry against Opportunity, that the oneness of the Shakespeare of the plays and the Shakespeare of the poems is most clearly seen. The former should be compared with Iachimo's description of Imogen as he creeps from his trunk and robs her of the bracelet which is to be

* "Feeling" is here used adverbially for feelingly.

the false token of dishonour, and the latter with Falconbridge's abuse of Commodity.

In particular the latter comparison should be carefully made by all who feel tempted to cut the Gordian knot of the Shakespeare marvel by supposing that it was another than Shakespeare who wrote the plays. "Thou ceaseless lackey to eternity, thou foul abettor, thou notorious bawd, thou ravisher, thou traitor, thou false thief," says Lucrece, in her anguish; but at the last she sorrowfully says, "In vain I rail at opportunity." In like manner, Falconbridge, in his bitter disgust at the mad composition made by the kings, speaks of "This Commodity, the bias of the world, that daily break-vow, that bawd, that broker, that all-changing word"—then at the last asks, angrily, "Why rail I on this Commodity?" If two men wrote these tirades, then we may well believe that the "Inferno" and the "Paradise" came from diverse hands.

SCIENCE AND RELIGION.

IN the June, 1886, number of Knowledge appeared an article called "Science and Politics," in which we touched on the absurd idea that men of science, as such, are less qualified to form just opinions on political questions than farmers, tradesmen, manufacturers, brewers, or bankers, whether in their simple condition as such or after the process of election to our great parleying house. We pointed out that while the man of science is altogether out of his element, and indeed is acting altogether out of character, when he expresses opinions about political questions which he has not studied, he is not more out of his element in so doing than the farmer, banker, or merchant who does likewise, even though the farmer, banker, or merchant may have intensified such original ignorance of political matters by many years' practice in parliamentary procedure. And we showed further that the training of the student of science of these times, while it tends, on the one hand, to make him carefully avoid any expression of opinions about matters which he has not studied (caution which the average merchant, farmer, brewer, or banker does not invariably display), tends also, on the other hand, to make him examine carefully, and even anxiously, into the hidden causes of things, where persons not so trained are content to note sequence only, inferring causation unhesitatingly where there may not be even any connection whatever. The real difference between students of science and others in this matter, and that which has led to the mistaken idea that they think less about political and social problems than others, lies in the circumstance that they less frequently express opinions on such matters. The rest of the community, without thinking more—nay, probably thinking less—are seldom troubled by any doubts as to the justice of their views, and so speak openly and freely. People are accustomed to hear them thus speak at public gatherings, while the more thoughtful, or those who are more fully conscious of the difficulties of the problems dealt with, remain silent. But this should not lead to the conclusion that the loudest-voiced are the wisest or the best informed, or therefore the fittest to express an opinion (even though such opinion may be merely negative). On the contrary, it has been a misfortune to our own country, and is recognised as a still deeper trouble among our kinsfolk in America, that the people who undertake most confidently to deal with political matters, and who are least cautious in considering doubts and difficulties, are those least fitted for the task of guiding or controlling political events. Insomuch that while in England the term "politician" has become one of doubtful respectability, in America it is not a doubtful term at all, but expresses an unpleasant cross between charlatan and rogue.

A similar mistake affects the ideas most men form as to the fitness of the student of science to express opinions about religion. The mistake may, indeed, be not quite so obvious. For it depends on a notion very commonly entertained, and encouraged by the class to which it relates, that there is a certain set of men expressly trained for religious study, and especially fit, because of certain imagined qualities, to form just opinions on religious matters.

Let us at the outset note that we are not here considering what has been called—absurdly enough—the conflict between religion and science. There is no such conflict, and there never has been. "The real contest," as Fiske well remarks (in an essay on Draper's overvalued work on the imagined conflict), "is between one phase of science and another; between the more crude knowledge of yesterday and the less crude knowledge of to-day. The contest, indeed," as he proceeds to say, "is simply, as presented in history, the measure of the difficulty which men find in exchanging old views for new ones. All along, the practical question has been whether we should passively acquiesce in the crude generalisations of our ancestors or venture to revise them. But as for the religious sentiment, the perennial struggle in which it has been engaged has not been with scientific inquiry, but with the selfish propensities whose tendency is to make men lead the lives of brutes. Viewed in this light, religion is not only something that mankind is never likely to get rid of, but it is incomparably the most noble as well as the most useful attribute of humanity."

It is not, however, with this imagined conflict of science with religion, but with the fitness of the student of science to form and formulate opinions about religion, that we are here concerned. Nor are we opposing the truism sagely enunciated by George Eliot, among others, that the man of science is no worthier of a hearing than his fellows when he speaks of that which he has not specially studied. *Cela va sans dire.* The mistake to which we direct our argument is the commonly-adopted notion that men of science, as such, have not as good opportunities as other men, and are less disposed than most men, to examine and inquire into religious questions.

Men who are neither scientific nor clerical (to include in this word the priests and ministers of all orders in all religions) are for the most part content to take their religious ideas from the ministers of that particular religious body in which they happen to find themselves. To such men it naturally appears a mistake, and indeed an emphatic nuisance, for men not clerical in the wide sense just indicated, to form or express any opinions at all about religious matters. For, such expressions of opinion disturb their calm content in ideas about which they have never cared to think, or rather in the belief that there *are* religious ideas which other men have thought about, and which probably they themselves would accept as matters of opinion if they could spare time to think them out. Those who think they believe are as numerous as those who believe they think. The two classes, which include the great majority of men, overlap largely, though of course there are many who do not even believe they think, nay rather accept the doctrine that most men *ought* to believe (whatever doctrine lies nearest to them) without thinking at all. And this is perhaps as well, seeing that otherwise a somewhat dangerously large number of folk might be troubled with the thought that either the doctrine accepted by them (as lying nearest at hand) may be unsound, or else the other doctrines must be unsound which are accepted in like thoughtless way by the immense majority of their fellows. Besides the men who think and those who believe, besides those who think they believe and those who believe they think, the world must for the present have many who think they ought to believe, absurd though the idea of duty in connection with belief most assuredly is.

Under these curiously mixed and unsatisfactory conditions, the unthinking are content to believe that there is a set of men specially trained and specially fitted to examine the doctrines which happen to be those they themselves unthinkingly accept. So that if a student of science, accustomed to weigh and examine causes, and to speak with confidence only when (which is seldom) he has been satisfied with evidence, should express an opinion about matters seemingly touching such doctrines, the unthinking many console themselves by cheerfully concluding that he is out of his depth, resting content in the belief that only the members of that particular set of trained clerics can form just opinions about such matters.

In reality, however, the case is otherwise, with regard to nearly all the doctrines about which our Spencers, Huxleys, Fiskes, and others have spoken, or which the researches of science have appeared to touch. In the Roman Catholic Church, indeed, as among Buddhists, Mohammedans, and Jews, there are classes specially trained in theological study or even for dogmatic disputation. But the matters about which these trained men are alone competent to speak with authority are questions of ritual or doctrine lying within their own special church, and of little interest to outsiders. A Huxley or a Spencer may find himself at a loss, for example, in discussing with a Roman Catholic theologian such a question as the treatment of Galileo by Roman Catholic ecclesiastics—not because of any misapprehension of the subject really at issue, but from want of knowledge of the details of ecclesiastical procedure in such matters. But even within the strict limits of Catholicity, Buddhism, Mohammedanism, and Judaism, the really important problems of religion remain untouched in the systems of training adopted for ministers of various orders. Nay, those systems tend to narrow and limit the powers of the trained ministers, by directing their attention solely to points within a certain circle deemed sacred, and leaving them no scope for survey outside of it.

In the various nonconforming bodies which lie outside Catholicity, there is not any recognised system of training, of any value, which should fit men specially for religious discussion, and no training whatever which can enable them to deal with the higher and nobler problems of religion.

Take, for example, what is called the Established Church of England. This church, though singularly broad, yet has its definite limits of belief, within which a man may, if he will, call himself "a member of the Church of England as by law established," while outside those limits he must be regarded as a dissenter. Now, theoretically, the Articles of the Church define these limits, and every minister of the English Church should be thoroughly versed, not only in all that these Articles define, but in regard to the limits within which each Article must be understood. If all clergymen of the Established Church were so trained and taught, that would not mean much, nor would it in the slightest degree touch on the wider question we are considering. It would only imply that there was a certain set of men who could speak with authority as to the doctrines which a member of the Church of England may or may not accept: as to the wider questions relating to religion itself, regarded as "the most noble and most useful attribute of humanity," such training, even if it were systematically adopted, would be valueless.

But no such system even as this has been adopted. Though all our clerics are not trained at our universities, we have in these universities the chief and probably the best types of training for the ministry. What does such training amount to? The crowds which fill our churches probably imagine that the surpliced teachers to whom they listen have been specially selected from among those having a special calling to such work, and have then undergone special training—some such training as a lawyer, or a doctor, or a merchant, or an artist, or even a man of science, requires for successful work in the business of his life. But the actual case is very different.

As to calling:—It is well known that ninety-nine out of a hundred of the young men who go up to our universities (or to separate colleges) to be trained—save the mark!—for the ministry, have no calling that way at all. They form a section, taken as it were at haphazard, from our British youth. If there is any selection at all, it is such as arises from the thought in a father's mind that a son seems unlikely to succeed in law or medicine or business: or it may be that there is promise, through some family circumstances, of a good opening in the clerical way; or other such reasons operate. But this is not the kind of selection thought of when we speak of calling.

Then as to training:—Noting first that the material if equal is certainly not superior to the average, either in ability, or in what should be rather important in this special profession, in earnestness and strictness of character, the system applied to that material is not such as to fit it specially for the study of the higher and nobler problems of religious philosophy. Even in what may be called Anglican theology, most of the clerics sent out from our universities are ill trained. We do not say it is at all necessary that most of them should be well trained, seeing that their work in country places—the "holy vegetable" life, as Sydney Smith put it—requires no special training in the details of Anglican theology. But, for the argument we are here considering, viz., that clerics and clerics only should speak about religious matters, this particular shortcoming in the training of the average English clergyman must certainly be taken into account. Be it noticed that we are finding no fault with the system. Taking several hundred young men, most of them of only average brain power, and of perhaps less than average earnestness of purpose, but on the whole very fairly representing the intellect and character of their race, what can our ecclesiastical system do with them? Too high a standard would keep the majority of them out altogether, and then what would our country towns and villages do for clergymen? This would be disestablishment of the most unsatisfactory sort. Better to let them through with a little Latin and less Greek (not one out of ten can read the Epistle to the Romans in the Latin Vulgate, and not one out of a hundred can read that epistle understandingly in the Greek), a very small quantum of mathematics (the connection of which with religion is too obvious to need insisting on), and, finally, that very slight smattering of theological matter which the "voluntary" (so called because involuntary) requires to be "got up" in a week's reading—apparently so that it may be forgotten six weeks after ordination.

We would not be understood as speaking slightingly either of the average attainments or of the average character of the clergy of the Church of England. If our universities were chiefly used for the education of lawyers, doctors, or merchants, the results in all probability would be much the same. Among a hundred lads in a school, there will be one or two who are clever, nine or ten above the average, forty or fifty below it, and the rest duffers. There will be a few of fine character, many neither good nor bad, and a few of very poor character indeed—to put the matter mildly. In a college it is the same; in fact, most of the young men in our colleges were lads in our schools a few years before. Thus there are a few capital classical scholars and first-rate mathematicians in our colleges, while there are numbers who are above the average in ability and education; but there are many times as many more who are below; and some are unutterably stupid. For the sake of these last, the Church ministry has to be made very easy of entrance: how easy only those know who have either gone through or have at least paid all such educational toll as the through passage requires. We who write learned much more theology in a year at King's College, London, at the ripe age of eighteen, than many of our fellow-Cantabs, now in the Church, learned during their University career. Many were unable, and not a few were unwilling, to learn more than just took them through, perhaps after much preliminary plucking. Yet not a particle of the small allowance of theological training necessary to admit bearer to the pulpit, scarcely a particle of the course of theological study which the better intellects pursued, had any bearing whatever on the wider or nobler problems of religion.

As to earnestness of character and purpose, English clerics present the same variety as English college youths, or as lads at English schools. But college life is not calculated to make men more earnest than they would have been without it. The future surpliced teacher in our country pulpits and parsonages is generally a good sort of fellow while at college. He probably plays a good game at cricket or tennis, or he rows well and staunchly, or he may be good both with the oar and the bat. He plays generally a fair hand at whist, and he usually likes good wine and good cheer. We like him none the worse for these innocent tastes and qualities: but they are *not* such as to assure us that he is exceptionally earnest in religious matters, or that he will be much better able than the student of science to solve perplexing problems of religion or philosophy.* For, be it remembered, the man of science usually *has* had a special calling, he possesses usually special ability, and he has usually had a special training for discussing questions whose relation to the higher philosophy of religion is somewhat nearer than the relation of whist or cricket, or even Greek and Latin syntax, to theological and doctrinal problems.

If the English Church, which being established may be supposed careful in such matters, has no class of trained teachers, though individual members of her priesthood may have studied her specific doctrines with special care, we may be sure that no body of Nonconformists is better provided with profound thinkers who are specially able, because of true calling, marked abilities, and long-continued study, to speak with authority, even about doctrinal matters. Individual preachers may in this sense be competent teachers, but the greater number cannot be. Assuredly whether they might be or could be, they *are* not, as their preaching shows. And even did each religious sect provide a class of teachers duly qualified and thoroughly trained, the wider and nobler questions of religion—which are not the dreary problems of theology, church history, or ritual, but far higher and far worthier of study—would not be brought within the scope of such teachers.

We should not care to define what qualities or what training would best fit a man for the discussion of the nobler problems of religion or philosophy. We believe that the best and purest, the most earnest and thoughtful, the man of keenest intellect and most fervent imagination, is not fit to penetrate within the temple wherein the Divine Mystery is enshrined. But among all men, though all men be unfit, none can nearer attain fitness to approach the temple than those who contemplate the Mysteries of Infinite Time and Infinite Space, of Infinite Might and Infinite Life, all ruled by Infinite and Eternal Law. They alone perceive what marvels of knowable truth lie within the infinite domain of the Unknowable.

* A friend of the writer's, whom we will call S., called a year or two after taking his degree on a college friend, whom we will call H., a parson in a dull but devout village. They were talking over the pleasant days of yore at dear old "John's," when two old ladies called to inquire how grace might best be obtained. "Don't go, S.," said H., who devoted for awhile his apparently most earnest attention to the old ladies' trouble. At last, *sat prata biberunt*, the visitors departed, full of praise for the "excellent young man," whose carefully parted hair and mark-of-the-beast waistcoat had probably impressed them fully as much, had they but known it, as the well-worn platitudes he had addressed to them. With a sigh of relief, as he closed the door after them, the excellent young man, who really was a good fellow, though not over-earnest, turned to his friend, saying, "Thank goodness, those two old cats are gone! Come, S., my lad, let's have some beer." Our friend H. typifies a class—and, by the way, those two old ladies typify another. And both classes are very much larger than many imagine.

THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

By Edward Clodd.

PART II.

CHAPTER VI.—FACTS IN SUPPORT OF DERIVATION OF SPECIES.

THE evidence supplied by living things in support of their common descent is fivefold: viz., 1, in their beginnings and development; 2, in their structural likenesses; 3, in their typical divisions; 4, in their succession in time; 5, in their distribution in space.

I. *Embryology.*— The eggs or germs from which all living things spring are simple cells, made of the same sticky stuff called protoplasm, and are, to outward seeming, exactly alike. And this likeness persists through the earlier stages of all the higher animals, even after the form of the living thing is traceable in the embryo. In proof of this Darwin quotes the following from Von Baer, the discoverer of this remarkable fact:—

"In my possession are two little embryos in spirit, whose names I have omitted to attach, and at present I am quite unable to say to what class they belong. They may be lizards or small birds, or very young mammalia, so complete is the similarity in the mode of formation of the head and trunk in these animals. The extremities, however, are still absent in these embryos. But even if they had existed in the earliest stage of their development we should learn nothing, for the feet of lizards and mammals, the wings and feet of birds, no less than the hands and feet of man, all arise from the same fundamental form."* In further evidence of this inter-relation of living things, their embryos epitomise, as it were, during development, the series of changes through which the ancestral forms passed in their ascent from the simple to the complex; the higher structures passing through the same stages as the lower structures up to the point when they are marked off from them, yet never becoming the form which they represent for the time being. For example, the embryo of man has at the outset gill-like slits on each side of the neck like a fish; these give place to a membrane like that which supersedes gills in the development of

* "Origin of Species," p. 388.

birds and reptiles: the heart is at first a simple pulsating chamber like that of worms; the back-bone is prolonged into a movable tail; the great toe is extended, or opposable, like our thumbs and like the toes of apes; the body three months before birth is covered all over with hair, except on the palms and soles, like the soles of four-footed animals. At birth the head is relatively larger and the arms relatively longer than in the adult; the nose is bridgeless; both features, with others which need not be detailed, being distinctly ape-like. Thus does the egg from which man springs, a structure only $\frac{1}{125}$th of an inch in size, set before us the history of his development from fish-like and reptilian forms, compressing into a few weeks the results of millions of years. That which is individual or peculiar to his race, the physical and mental character inherited, is left to the slower development which follows birth.

The gills in his embryo, as also in that of other mammals, are one among many structures, more or less rudimentary, which witness to the unity of origin of every living thing. Certain organs appear in the fœtus which are useless to the adult, as teeth in whales, remnants of hind limbs in certain snakes, wings under the wing cases of insects that do not fly, rudiments of pointed ears in man, abortive stamens in plants, as the snapdragon, and so forth. Except as evidence of the modification of life-forms in which they occur from other life-forms, and of persistency of type, they are meaningless; the functions they once discharged have long ceased, being exercised only in other and allied living things where they are found fully developed.

II. *Morphology.*—Large groups of species, whose habits are widely different, present certain fundamental likenesses of structure. The arms of men and apes, the fore-legs of quadrupeds, the paddles of whales, the wings of birds, the breast-fins of fishes, are constructed on the same pattern, but altered to their several functions. Nearly all mammals, from the long-necked giraffe to the short-necked whale, have seven neck-bones: all insects and crustacea—moth and lobster, beetle and cray-fish—are alike composed of twenty segments; the sepals, petals, stamens, and pistils of a flower are all modified leaves arranged in a spire. Such facts need no comment.

III. *Classification.*—It has been already shown that all animals may be reduced to three types: the first, or lowest and simplest, without body cavity: the second, or intermediate, with body cavity: the third, ranging from the earth-worm to man, with digestive cavity separate from body cavity. The general likenesses of structure upon which a classification of living things is based have been detailed in the chapters on existing life forms,* and here the reminder suffices that the old attempts at a linear arrangement have failed, and that the only true mode of presentment, both of the life that is and that was, is that of a tree with short trunk, indicating common origin of the living from the non-living, and divided into two large trunks representing plants and animals respectively. From each of these start large branches representing classes, the larger branches giving off smaller branches representing families, and so on with smaller and smaller branches representing orders and genera, until we come to leaves as representing species, the height of the branch from which they are hanging indicating their place in the growth of the great life-tree.

IV. *Succession.*—All extinct forms have their time-range, all living forms have their space-range, and, if the theory of descent has any truth in it, their ancestors must be sought in the past. Broken as is the record, the great mass of it beyond reach, and the little that is within reach only thoroughly examined here and there, the accord of the facts of geological distribution with the facts summarised above is nevertheless complete. Each formation has its peculiar groups of fossil remains representing the life-forms of the period; the older the rock, the simpler are its organic remains, and, what is of no mean importance, although transitional forms are from their nature fewer and less permanent than forms which have arrived at balance with their surroundings, the fossil-yielding rocks have disclosed the existence of several hitherto missing links between species. Reference to some of these has been made in the summary of past life-forms, *e.g.*, to the proofs of descent of the one-toed horse of to-day, with his knee corresponding to our wrist or ankle, from the five-toed primitive horse found in the Eocene beds of North America, and to the connecting link between birds and reptiles supplied by the Archæopteryx. To this may be added the Compsognathus, with its swan-like neck, its toothed jaws, and hind limbs, on which it walked. Then there are the links between pigs and ruminants in the Anoplotherium; between tapirs, horses, and rhinoceroses in the Palæotherium: and in the Devonian strata forms occur which are considered intermediate between ganoids and mud fishes. Thus one by one the blanks are being filled up; the faith of the biologist is justified by his works.

V. *Distribution.*—Every living thing has its definite area of range: the sloth is peculiar to America, the hippopotamus to Africa, the chamois to the Alps; Arctic plants wither under the equator: those of the tropics perish in cold or even temperate zones, while a vast number flourish only in the original birthplace of all life—water. Among animals a few, notably man and the cat genus, have spread themselves well nigh everywhere: but, as a rule, certain species are restricted to certain regions, and hence the biological division of the land into regions corresponding to that distribution, and of the water into life regions measured by the limits of depth at which marine forms are found. Speaking broadly, the plants and animals of countries in unbroken connection resemble one another, while those of countries remote or cut off are unlike. But these general principles bristle with exceptions. In countries where the climate and general conditions correspond, as the equatorial regions of both the Old and New World, as also on the same continents, there are marked differences in the life-forms, probably owing to impassable barriers of mountain ranges, deserts, or oceans, while in countries with different climates, as in tropical Florida and frozen Canada, allied types are sometimes found. Puzzling and capricious as the distribution of life may seem—*e.g.*, tapirs are found only in South America and Malacca, with its neighbouring islands, being thus separated by nearly half the globe's circumference—in this, as in aught else in nature, nothing is accidental. Distribution is due to the migration and transport of living things, which, under the agency of natural selection, become more or less adapted to new conditions, and much light comes therefrom, not only on the theory of the origin of species, but also upon past changes in the relations of land and water. Where allied forms which are unable to cross the seas are found in lands now separated, as in Britain and Japan, in Southern Europe and North Africa, we have evidence of former union; the degree in which species have been modified giving some key to the remoteness of that union.

In the study of the very complex problem of distribution, islands afford important aid. They are of two kinds, continental and oceanic. The continental have been broken off from the mainland, as the British Isles, Japan, the far more ancient Madagascar with its lemurs, and New Zealand with its wingless birds and remarkable one-eyed lizard. The oceanic, as the Azores and Sandwich Islands, are of

* *Vide* Knowledge, June to October, 1886.

volcanic or coralline formation, and depend for their life-forms upon their relative position to the mainland, and also to the winds and ocean-currents that prevail. Exclusive of animals introduced by man, they are found destitute of frogs and other batrachians; also of mammals, bats excepted; the explanation being that sea water kills frogs and toads and their spawn, and that only flying animals can cross the ocean. For this reason bats, at least the insect-eating species, are found everywhere, except at the Poles; and the range of birds, although defined, is much wider than that of all the larger and wingless land-animals.

Isolated islands like St. Helena are peopled with waifs and strays from all quarters, while in continental islands like our own the life-forms are, for the most part, identical with those of the nearest mainland. But here, again, exceptions exist. The islands of Bali and Lombok in the Malay Archipelago, although only fifteen miles apart, differ far more from each other in their birds and quadrupeds than do England and Japan, the birds being extremely *unlike*.* As shown by the deep soundings, Bali belongs to the Indian region, and Lombok to that zone of "living fossils," the Australian region. Australia contains only the lowest mammals, as duckbills and kangaroos—for there is little doubt that the dingo was introduced by man—witnessing to its severance from Asia millions of years ago during the Secondary epoch. It is an ancient and little altered fragment, preserving the types of plants and animals which were then dominant on the great shifting land areas, and from which the higher forms have been developed.

Oceanic islands, with their population of birds, flying insects, and a few creeping things, are the refuge spots of castaways. Strange are the ways and means of dispersal. Winds waft and currents drift to distant shores icebergs laden with earth and seeds, or masses of floating vegetation, sometimes so matted with soil as to form island-rafts with trees upstanding, and carrying with them not only numbers of grubs, and eggs of insects, but even large animals. Birds are important agents in plant distribution, transporting seeds embedded in dirt sticking to their feet or beaks, or the barbed seeds of certain plants, like the curious *Uncinia*, which cling to their feathers, or the undigested seeds and stones of fruits which are passed through their bodies. A swift-winged bird may drop cherry-stones a thousand miles from the tree they grow on; a hawk, in tearing a pigeon, may scatter from its crop the still fresh rice it had swallowed at a distance of ten degrees of latitude. Among the many suggestive experiments which Darwin made in this matter, he cites the case of the leg of a wounded partridge to which a ball of hard earth weighing six and a half ounces adhered. The earth had been kept for three years, but when broken, watered, and placed under a bell-glass, no less than eighty-two separate plants of about five distinct species sprang from it.

Very important, also, although more remote in its ultimate results, is the agency of man, especially of civilised races, in the distribution of life. Both with and without intent he distributes and destroys, as his needs or caprices demand. Clearing forest, draining lake and bog, reclaiming land from sea, or uniting ocean with ocean, he disturbs, or mingles, or kills their life-forms. He imports strange plants and noxious insects in his merchandise; he transports the healing cinchona plant from Peru to India, the salmon ova from our native streams to the rivers of Australia, and to him is due the re-introduction of the horse into America, which had been extinct there long before the arrival of Columbus. "The *hortus siccus* of a botanist may accidentally sow seed from the foot of the Himalayas on the plains that skirt the Alps; and it is a fact of very familiar observation that exotics, transplanted to foreign climates suited to their growth, often escape from the flower-garden and naturalise themselves among the spontaneous vegetation of the pastures. When the cases containing the artistic treasures of Thorwaldsen were opened in the court of the museum at Copenhagen where they are deposited, the straw and grass employed in packing them were scattered upon the ground, and the next season there sprang up from the seeds no less than twenty-five species of plants belonging to the Roman Campagna, some of which were preserved and cultivated as a new tribute to the memory of the great Scandinavian sculptor, and at least four are said to have spontaneously naturalised themselves about Copenhagen."*

While needless destruction has too often followed in the wake of man, as he humours the cruel freaks of fashion, or kills out of sheer wantonness, his enterprise has, on the other hand, ridden the soil of harmful weeds and baneful animals; developed food from wild or useless plants; luscious fruits from sour and dwarfed species; and domestic animals, the dog probably earliest of all, from the fierce beasts of the forest and the plain.

Enough has been said to show that no pre-ordained scheme of fitness for their several habitats has placed plants and animals where they are found. So far as most of the higher life-forms are concerned, our best authorities, with Mr. Wallace at their head, incline to the theory of their first appearance in the Euro-Asiatic continent, the wave of migration rolling over the Old World far south by routes long submerged, and by a northerly land route into the New World. And, since few birds and insects are capable of crossing the great oceans, it seems likely that they took the same course, in confirmation of which we find that those birds which migrate between Europe and Africa travel by way of Greece, Malta, and Gibraltar, the three points at which those continents were once united.

* Wallace's "Island Life," p. 4.

* Marsh's "Man and Nature," p. 67.

THE OIL STORES OF AMERICA.

AMONG the most pleasant and interesting features of lecture travelling must be set the opportunities offered for studying various characteristic regions of the earth. During my own lecture travels in England, Scotland, Ireland, and Wales, in nearly every State and Territory of America, in Canada, Australia, Tasmania, New Zealand, and so forth, I have had many opportunities of this kind. For in most regions where anything of special interest is to be seen, I have found many ready, nay eager, to show and explain what is chiefly to be noted.

I propose now to make some remarks about the oil regions and the oil industry of Western Pennsylvania and South-western New York, a subject to which my attention has naturally been turned during that part of a short lecture tour I am taking which brought me to Fredonia, N.Y., Meadville, Pa., &c. Of course, I only propose to consider the subject in its scientific aspect, though I may have to remark on the singularly wasteful way in which nature's earth stores have in this case been drained, till what took many millions of years to accumulate has been probably more than three-fourths consumed in fewer than thirty years.

The first question naturally asked in regard to these oil supplies is, How came they there? Of course, to answer this question fully and in detail would be a very difficult task, and is at present certainly impossible. But, speaking generally, it may be said that the choice lies between two theories, in greater or less vogue among geologists; while, so strongly does all the evidence bear on the side of one of these, that it is very difficult to understand how any doubt can remain as to its essential validity.

Let it be premised that the oil occurs chiefly in what are called pools, though they are not in the slightest degree like pools—certain sands found at a greater or less depth beneath the surface, and permeated with oil in such degree that in some cases a cubic foot of oil is obtained from every ten or twelve cubic feet of sand. Intermixed with the oil is a gas which also is found collected in many places above the oil pools, in a highly compressed state. This gas is variously constituted in different wells. It always contains a large proportion of marsh gas—the gas which rises from the ground above places where animal or vegetable matter is undergoing processes of decomposition. It also contains hydrogen, carbonic acid gas (or what chemists now call carbon dioxide), ethyl hydride, and several hydrocarbons. The petroleum itself has been formed from the condensation of a portion of this compound gas. The proportions of the several gases vary in different wells. Thus, while marsh gas amounts in some wells to nearly 90 per cent. (89·65 is the highest amount yet deduced from analysis, I believe), gas from the Cherry-Tree well shows only 60·27 per cent. of marsh gas. Hydrogen ranges from 6·6 to 13·5 per cent. in other wells, but in gas from Cherry-Tree well amounts to 22·5 per cent. In like manner carbonic acid gas, which has a range of from $\frac{35}{100}$th to $\frac{66}{100}$th per cent. in gas from other wells, runs up in the Cherry-Tree gas to 2·28. Again, while there is no trace either of oxygen or nitrogen in the gas from most of the oil districts, we find in the gas from the Cherry-Tree well $\frac{83}{100}$th per cent. of oxygen and 7·32 per cent. of nitrogen. Of ethyl hydride, which may be regarded as the chief component of all the petroleum gases outside the marsh gas and the permanent gases, we find the percentage ranging between 4·39 and 18·39 in other wells, and amounting to 6·80 in the Cherry-Tree gas. I have been somewhat particular in noticing the exceptional nature of the gas from the Cherry-Tree well, because it illustrates strikingly the effect which local peculiarities may have in modifying the chemical constitution of the gas found in the oil districts. The Cherry-Tree gas reaches the surface through water; we can understand well, then, that it should contain a relatively larger proportion of hydrogen, oxygen, nitrogen, and carbonic acid gas (with which the water is largely charged).

It is worthy of notice, however, that the structure of the sands in which the oil is chiefly found by no means affects in similar degree, or even in any appreciable degree at all, the character and chemical constitution of the oil. This is the first, and perhaps most striking, piece of evidence showing that the oil was not originally formed where it is now found. For convenience I present the evidence on this point, in company with other evidence about the oil regions which is full of interest, though not bearing directly on the question of the origin of petroleum.

The sand from which the oil in the Allegany (not Allegheny) and Bradford districts is obtained consists of a grey-black, dark-brown, or chocolate-brown coloured sand, singularly uniform in texture, of about the coarseness of the ordinary black sand of the New Jersey coast. The oil obtained is dark amber-green in colour, and occasionally black. The specific gravity is about half that of water, that is about 50. The Bradford oil region has an extent of about 133 square miles, and up to January 1, 1885, had produced 820,000 barrels per square mile, or 109,000,000 barrels in all. The Allegany region has an area of 31 square miles, and to the same date had produced 15,000,000 barrels of oil, or 419,000 per square mile. Now the sand of the celebrated Venango district consists of white, grey, and yellow pebble rock—the pebbles being obviously water worn, and as large as hazel-nuts, loosely cemented and bedded in fine sand, which is by no means so regular as that of the Allegany and Bradford regions. Hence there are dry tracts (holes they are called, being no more holes than the rich tracts of oil sands are pools) where the oil has not gathered. The oil in the Venango district is generally green, but frequently black, and sometimes amber. Its specific gravity ranges from 30 to 51, but may be regarded as averaging about 48. This district has an area of 65 square miles. The total produce to the beginning of 1885 amounted to 55,000,000 barrels, or 846,000 barrels to the square mile. The Butler district has an area of eighty-four square miles. The sands resemble those in the Venango region, and the oils obtained are similar in colour and specific gravity. To January 1, 1885, the supply of oil from this region amounted to 69,000,000 barrels, or to 821,000 barrels per square mile. From the Beaver district, sixteen square miles in extent, 1,000,000 barrels had been obtained by the beginning of 1885, corresponding to 62,000 barrels per square mile. In this region the sand rocks correspond with those called the Pottsville conglomerate and the Berea grit in the sub-carboniferous series. The oils obtained from the Butler district are mostly amber-coloured. In the Warren region, thirty-five square miles in extent, the sands vary greatly in character. The total produce to January 1885 was 12,000,000, or 343,000 barrels per square mile.

When we notice in the Venango drillings coarse sand and pebble, and pieces of pulverised rock showing no traces of petroleum, we cannot but feel how unlikely it is that such a rock could ever have contained enough organic matter to yield a cubic foot of oil to every ten or twelve cubic feet of rock. Again, it is obvious that in such a rock substance organic matter would decompose and waste. The organic matter could not have found its way into those pebbly sands while they were exposed to atmospheric influences, for in that case the oil would have been volatilised and dissipated. Nor could it have been accumulated when these sands were in contact with the water: for then the oil, being of much lighter specific gravity, would have risen to the surface and floated away as fast as it was formed. The oil must, then, have been introduced into these sands long after they formed part of any shores, or were near to the surface of the earth's crust, whether that surface above these sands were under water or not.

But perhaps the strongest argument against the theory that the oil was formed *in situ* resides in the very special way in which the oil is distributed in layers at different depths, but under the same place. Of course, if each sandy tract originally supplied its own organic material, animal and vegetable, from whence, long after, oil was formed (the region sinking to depths where the heat and temperature were sufficient to decompose the organic material and generate from it vast quantities of gas), we could not expect any connection to be shown between the distribution of the oil in one sand pool and the distribution in another lying below it (at so great a depth as to indicate very long time-intervals between the formation of the respective sands). But a singular connection is actually recognised, the meaning of which seems unmistakable. Wherever a tract of oil sand overlies a lower rich oil sand the upper sand is always poor. But if portions of a lower oil sand are rich and other portions poor, then the upper oil sand is rich where the lower is poor, and poor where the lower is rich. Again, where an upper sand tract extends farther than a lower one, the part overlying the lower will be poor, while the part extending beyond the lower will alone be rich. Still more marked and significant are the peculiarities recognised when there are three sand tracts at different depths, for in such cases, while the second is found to be richest where it extends beyond the lowest, and the uppermost richer where it extends beyond the second, the uppermost is richest of all where it extends beyond both the next lower and the lowermost of all. This corresponds exactly with what might be expected if the gas rising from organic matter, decomposing under the influence of high temperature, were absorbed by the overlying sand tracts, wherever the conditions were suitable, the absorption in any given sand tract, of course, diminishing the amount which could give rise to a sand tract above. The significance of this peculiarity can hardly then be misunderstood; we may safely conclude that it has been by this process of distillation, and not *in situ*, that the oils have been formed in the great oil-sand regions of Pennsylvania and New York.

It would seem as though the oil had been formed from the condensation of gas rising from the carbonaceous shale lying at greater or less depths below the sands where the oil is found. Such carbonaceous gas would be generated in immense quantities from materials brought into the region of the Appalachian range from various sources and at various times. Large quantities of organic matter were stored in the limestones and shales of the enormously thick beds of the silurian formation, augmented afterwards by the contents of rich carbonaceous deposits during the Lower Devonian age. From these masses of organic matter, submitted at times to high temperatures, and always at immense pressures, deep as they lay below the region of the oil-collecting sands, immense quantities of carbonaceous gas would rise, to be condensed in some regions into oils, but elsewhere to remain as gas at very high pressure, and ready to burst forth with amazing energy whenever an outlet should be found or forced for it. [It is to be observed that for the formation of the oil pools the carbonaceous shales and the sandstone rocks are both in equal degree necessary, the former to produce the oil-gas, the latter to retain it on its way towards the surface, where, unless thus captured, it would escape.]

It can hardly be doubted, I fear, that the supply both of oil and gas has now been so largely drawn upon that within less than a score of years scarcely any will be left which can be brought at reasonable cost into the market. The boundaries and extent of the oil regions have been determined. All the sands in which oil will ever be found in such quantities as to be worth working are known, and have been drilled through in various places. It is scarcely possible that any new fields will be discovered which will be comparable either in extent or productiveness with those now known. So far back as January 1883, Professor Lesley pointed out that no petroleum is now being produced in the Devonian rocks, either by the process akin to distillation, described above, or otherwise. What has been stored up in the past, a process which probably lasted for millions of years, may be got out. But when these reservoirs are exhausted there will be an end of the petroleum supply. "The discovery of a few more pools of two or three millions of barrels each can make little difference." Mr. Carll, whose opinion on the geology of the oil-bearing districts may be regarded as decisive, has come to a similar conclusion. "There are not at present," he pointed out quite recently, "any reasonable grounds for expecting the discovery of new fields which will add to the declining products of the old, so as to enable the output to keep pace with the shipments or consumption."

The stored petroleum in this region has then been very nearly exhausted. In less than a generation, a small part of the population of this continent alone has used up nearly all the valuable stores of energy which had been accumulated during millions of years of the geologic past.

More recent inquiries confirm the conclusions of Professor Lesley and Mr. Carll. The signs of exhaustion in the oil-producing regions can now be clearly recognised. During the last four years there has been a steady diminution in the output, accompanied by an increase in the price per barrel, which nevertheless does not even maintain the nominal annual value of the supply. Mr. Wrigley announced in 1882 that 154,000,000 barrels of oil had already been raised up to the beginning of that year, and expressed the opinion that not more than 96,000,000 barrels remained to be raised. In this last estimate he was undoubtedly mistaken, for up to the beginning of 1885 no fewer than 261,000,000 barrels had been raised, and in the year 1885 as many as 21,042,041 barrels (nearly 3,000,000 fewer than in 1884) were obtained. But although the estimate in 1882 of the quantity of oil still remaining fell far short of the truth, and though we may admit as possible that even now much more oil remains to be put out than the most experienced geologists suppose, the signs of approaching exhaustion are yearly becoming more unmistakable. The expense of bringing the oil to the surface grows greater year by year, and threatens soon to become so great that the profit of working the oil stores will be evanescent. So soon as that state of things is approached, we may be sure that the oilmen's occupation in Pennsylvania and Western New York will be gone. It has been stated that the Japanese, unwilling to let the least fraction of the earth's interior stores be lost, have been known to excavate a vertical shaft to a depth of 600 feet in order to raise a few gallons of oil per day. But in America when the oil mines are so near exhaustion as this, they will be abandoned; nay, they will be abandoned long before they approach such a condition. With the failure of the oil supply, all the collateral branches of industry associated with it will fail too.

CLOTHES-MOTHS AND THEIR ALLIES.

By E. A. Butler.

In a former paper we gave an account of one of the commonest of our clothes-moths, *Tinea pellionella*; it now remains to consider the other members of the same genus to which a similar epithet is applicable. And first as to *T. biselliella*. This is a little creature, something like *pellionella*, but usually rather larger and with shining ochreous fore-wings, which are perfectly devoid of spots; the hind-wings are paler, and the head reddish. Its caterpillar feeds upon various animal substances, such as hair, feathers, wool, &c., and so may occasionally be found in the linings of sofas and chairs, and in mattresses. It is an abundant insect, and its habits are similar to those of the before-mentioned species, but there is this difference, that the present insect does not, when a caterpillar, weave for itself a coat in which to go on its travels. At the commencement of its larval life it is said to feed without any covering by way of protection; but after a while it finds the necessity of preserving its delicate body from the attacks of its somewhat ill-tempered and aggressive companions, if from nothing else, and therefore constructs a kind of tubular tunnel in which to take shelter. This, however, is fixed to some support, and is thus a shed rather than a garment. It is in this run, too, that the change to the chrysalis takes place; but then the ends are closed up, and the dormant insect is thus secured from molestation during the period of its seclusion.

Even at this stage of its life it is a lively little being, any disturbance of its retreat being resented by petulant wrigglings of its brown, mummy-like form. When the time for its final change arrives, it shifts itself along to the entrance of the cocoon by means of tiny hooks on its back, and then works its way out of its pupa case, which it leaves projecting from the end of the cocoon. The larvæ may be found in our houses from February to September inclusive, and the moths from April to November.

The next species is *T. tapetzella* (fig. 1). This is considerably larger than the two preceding, and very different

Fig. 1.—Tinea Tapetzella.

from them in colouration, though sufficiently similar in shape to show that it should be referred to the same genus. When the wings are fully spread, the moth has an expanse of $\frac{3}{4}$ inch, and it may very easily be recognised by the startling contrast in the distribution of its colours. The fore-wings are black over their basal third part, and then over the rest of their area creamy white, slightly mottled with darker, especially at the tip. The hind-wings are shining brownish-grey and have long fringes. When the wings are closed, they are laid close alongside the body, and then, of course, no trace of the hind pair is seen. We have simply a long narrow object with the front part black and the hinder white.

This insect, in its larval condition, delights in coarser food than its predecessors, and devours with avidity such fare as carpets, horse-cloths, &c. The thickness and more substantial character of this food affords the grubs protection also, and renders the construction of a separate case unnecessary—as they burrow into the cloth, it is thick enough to conceal them, and they, therefore, only care to line their burrows with silk. In these tunnels they can reside and feed quite secure from observation. This insect is sometimes called the "tapestry moth," from the fact of its depredations occurring chiefly in such materials; the linings of carriages, too, are sometimes destroyed by it. The caterpillar may be found in April and May, and the moth in June and July. From its habits one may easily gather that it is less frequently met with in the house than in outbuildings, such as stables, coach-houses, &c. The writer once found quite a family of them in a piece of carpet that was used as a bandage round a young sapling in a garden, to prevent the cord by which it was tied up from injuring the bark.

Lastly, there is *T. rusticella*. This is less strictly a clothes-moth than the others; it seems to be in no way particular as to the exact character of its diet, provided it be of an animal nature and sufficiently dry, and in consequence it has been found in the most unlikely places. For instance, Mr. C. G. Barrett one winter collected a number of old nests belonging to chaffinches and other birds of that sort, nests that are largely composed of wool and hair, and on keeping them till the summer he obtained from them large numbers of Tineæ, the larvæ of which had been feeding on the materials of which the nests were composed, and amongst these were some specimens of the above insect. Again, it was found by Mr. C. Eedes in a more unsavoury locality still. He one day came across the dried-up corpse of a cat, and observing that it contained larvæ and pupæ of some moths, he kept it till the perfect insects appeared. Many of these turned out to be *T. rusticella*. In its natural state, therefore, this insect is clearly a devourer of animal refuse—in fact, one of nature's most useful scavengers; and if we introduce animal matters, though of far less objectionable character than these, into our houses, we need not be surprised that sometimes the scavenger follows them, intent upon the fulfilment of its natural function.

The caterpillar is, as usual, a whitish creature with a brown head. The moth, which is about the size of *T. biselliella*, is dark greyish-brown on its fore-wings, slightly tinged with purplish, and minutely speckled with yellowish dots; it has also a pale transparent spot on the disc of the wing before the middle, and another similar but smaller one at the outermost lower angle of the wing.

Various methods have been suggested for getting rid of these pests; this, however, is hardly the place for discussing the merits of rival insecticides. But there is one ingenious method which, if not very practicable, is yet so interesting that it must receive a passing notice. It is well known that silkworms are a prey to a certain disease called "muscardine," which arises from the growth of a parasitic fungus. The idea occurred to Balbiani that if the larvæ of clothes-moths could be inoculated with this disease, the result would be similar to what it was amongst the silkworms—their numbers would be speedily and rapidly diminished, and a benefit would thus be conferred upon mankind. He accordingly reduced the remains of some "muscardined" silkworms to a powder, and laid his trap by sprinkling this bait over clothes infested with the destructive larvæ. The grubs ate of the fatal meal, developed the disease, and miserably perished. The powder, however, was found to lose its efficacy to some extent if kept for any length of time.

These are all the insects that can fairly be called "clothes-moths"; but there are several other small moths that occur in our houses, and, being general feeders, are destructive in other ways, though they are generally credited with designs upon our woollen fabrics. Some of these belong to the same extensive genus as the clothes-moths proper—*e.g.*, *Tinea ferruginella* (very similar to *rusticella*, but smaller), *fuscipunctella* (also somewhat similar, but without the transparent spot), *misella* (yellowish brown, with paler markings and two dark dots), and *nigripunctella* (yellowish, with several blackish spots). Some of these occur not unfrequently, but others are rare.

But there are two insects which greatly exceed in numbers both these and most other household species, and are often more abundant and universally distributed than the clothes-moths themselves. They are *Endrosis fenestrella* and *Œcophora pseudo-spretella*, both representatives of a new and very extensive family of Tineæ, the *Gelechidæ*. A glance is sufficient to show this; for first, in rest, the wings lie flat along the back instead of by the sides, as in the *Tineidæ*; secondly, a hand-lens shows that the head, instead of being crowned with the erect, hairlike plumes of a Tineid, is covered, at any rate in front, with broad, flat-lying scales, which suggest the idea of their having been brushed over the forehead like the "fringe" of a modern English female; and thirdly, there is a pair of enormously large curved palpi, much longer than those of the *Tineidæ*, pointing upwards from beneath the head like a pair of miniature bull's horns.

The former of these insects (fig. 2) is literally ubiquitous. From appearing usually on windows, it has received the name *fenestrella*, or "window moth;" but it has also been called *lacteella*, or "milk moth," in consequence of being so frequently found drowned in the contents of milkjugs. The water-jugs and basins in our bedrooms also often testify to similar fatalities. It is really a very pretty little creature, and if only it were rare would be highly prized on account of its beauty, but being so abundant, and a "moth" to boot, its fair exterior goes for nothing, and it is only considered a nuisance. It has brownish fore-wings, speckled with darker, but its head and thorax are of a pure snow white. This description is quite sufficient to enable it to be recognised, for there is no other little moth like it. It is a larger insect than most of the preceding, and the wings, when fully spread, stretch about two-thirds of an inch. Its white head, which is an exquisite object for a low power of the microscope, renders it easily seen, and in consequence it has often to pay the penalty of death for crimes it has never committed. The finger of the careful housekeeper often comes

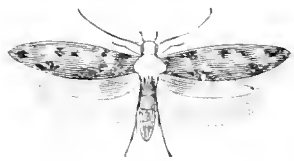


FIG. 2.—ENDROSIS FENESTRELLA.

down upon it with vengeance, treating it as a devourer of woollen goods, when the real culprits—such insignificant creatures as *T. pellionella* and *bisselliella*—by their smaller size and obscure appearance, escape notice. It is, in fact, not a clothes-eater; its larva feeds upon all sorts of waste substances, especially those of a vegetable nature, and thus, no doubt, often clears up for us a good deal of rubbish out of odd corners. It may be found all the year round, and probably there is scarcely a house anywhere of which it is not an inhabitant.

Though the presence of the window-moth in our houses may be condoned, the same cannot be said of its near ally, the detestable pest, *Œcophora pseudo-spretella*. This is one of the most destructive insects imaginable, and is apparently a perfectly general feeder; nothing that is in the smallest degree edible comes amiss to it. It is rather larger than *Endrosis fenestrella*, of a pale brown colour, more or less completely mottled over with dark brown, and with three very deep brown spots, two before the middle of the wing, placed one above the other, like a colon, and one beyond the middle. The distinctness of these spots depends upon the intensity of the ground colour of the wings, which varies a good deal. The hind-wings are paler without markings, and as usual have long fringes. When in good condition, which is not likely to be the case, except just after emergence from the pupa, the fore-wings are shiny. They are placed in a flat position over the back, and thus cause the insect to appear larger than a Tinea of the same size would. The moth is fond of concealment, and often hides amongst the substances that have suffered from its depredations. When disturbed, it runs rather than flies, and that very rapidly, at once seeking shelter again. To pursue it with one's fingers is no easy task; it is so rapid in its movements and so slippery when touched, in consequence of the glossiness of its scales, that the pursuit is apt to try both patience and temper of pursuer.

The caterpillar is a whitish creature with a brown head, of an active habit, but concealing itself most effectually by spinning together quantities of the material it happens to be feeding upon. It does not take the trouble to bite off neat pieces of this material and weave them carefully and deftly together, as the clothes-moths would do, but seizes hold of anything near, whatever its size, and attaches it, as it is, by one of its ends, so that the pile seems little more than an accidental heap. Under this it can feed at its ease. But a keen eye will soon detect traces of its presence, in the shape of pellets of excrement thrust out from the end of its tunnel. It is particularly fond of invading an entomologist's stores of insects, and if he be by any means careless enough to grant it a footing he will find immense damage done before he suspects anything, and also find that his little foes are very difficult of eradication. The ravages in such cases are really very cleverly concealed: *e.g.*, the unfortunate collector, noticing one of his larger moths, say, with its wings drooping apparently a little more than usual, essays to remove the specimen with a view to discovering the cause, when he finds that, as he pulls out the pin on which it is impaled, he removes no more than a mere shell of the body, and leaves the wings attached to the bottom of the box; *pseudo-spretella* has been at work, and has cleverly fastened down the wings of the moth, but in such a way as hardly to disturb their position, and then, using them as a roof, has proceeded to scoop out the contents of the body, being still careful to leave the skin entire, so that until the tug at the pin reveals to the chagrined entomologist the utter destruction of his specimen, it looks almost as perfect as ever.

From this habit of concealment, practised by both larvæ and perfect insects, it often happens that vast damage is done before the presence of the destroyer is suspected, and in any case the damage is sure to be great, so much more being spoilt by being woven into the roof of the shed than is really destroyed by being eaten. Mr. C. S. Gregson speaks of tons of rice in a warehouse having been destroyed by this insect. Each caterpillar had spun together six or eight rice-grains, and they thus made numbers of little bundles of rice, which they used both as shelters and as food. The same observer speaks of having been informed that some small caterpillars were doing great damage amongst the stores of sweeping-brooms belonging to one of the local government boards in Liverpool. On receiving specimens of the damaged articles, he found that they were ling besoms (brooms made of heather or ling), and that the destroyer was none other than *pseudo-spretella*, which, notwithstanding that all it had had to live upon was dry heather brooms, was nevertheless more fat and flourishing than usual.

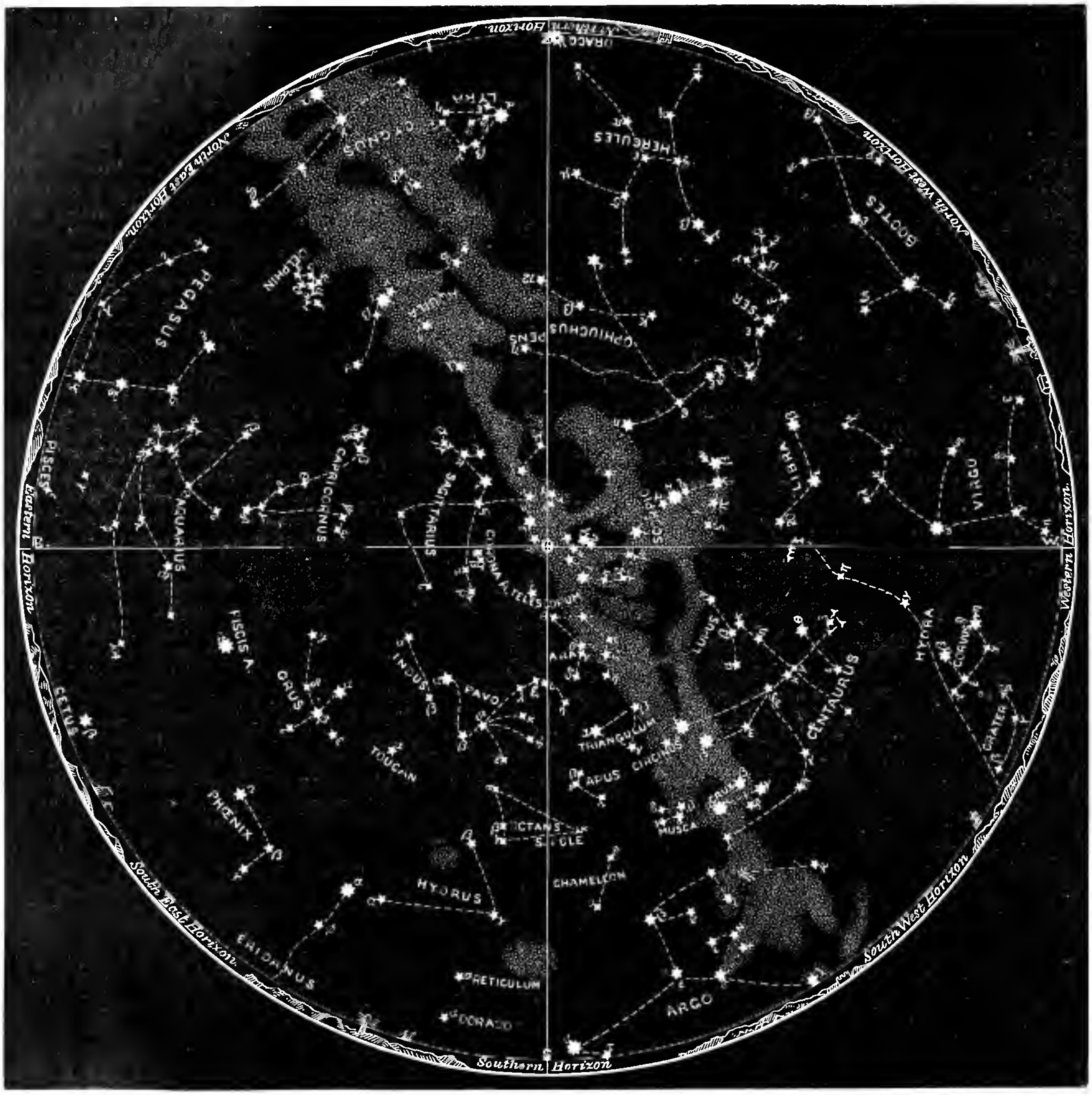
The larva of this insect is a winter feeder, and may be found in the early months of the year, the moth appearing in July and August.

A very near relative of these two insects, called *Œcogenia Kindermanniella*, is sometimes found in houses, especially near London. It is smaller than either of its allies, and is a very pretty insect, having the narrow fore-wings dark purplish-brown, with three broad pale yellow patches.

AMERICAN ENGLISH.—A Boston man tells how few in England understand American-English. "I had not been in Liverpool an hour," he says, "when I became convinced that I had much to learn about the English language. When I entered my hotel I asked the young woman who received me, 'What are your terms?' and had I spoken Choctaw she could not have understood me less. 'What do you charge a day?' I next ventured. 'Charge?' she replied, vaguely, and I gave it up. Another woman was summoned, and I tried again. 'Ah! you want the tariff?' she said at last, and sure enough I did. Now, if I had used the word 'tariff' in that sense in Boston, it would have been considered slang. [It is clear the mistake lay not in the words used, but in the thing signified; the Boston man misunderstood our hotel ways.] I tried in vain to get a pair of suspenders, as they would show me none but those for stockings, but succeeded finally in buying some 'braces.' I might prolong the list *ad infinitum*, but enough is shown to warrant the publication of an American-English dictionary of synonyms for the use of travellers."

THE SOUTHERN SKIES.

MAP VIII.—FOR MAY, JUNE, AND JULY.

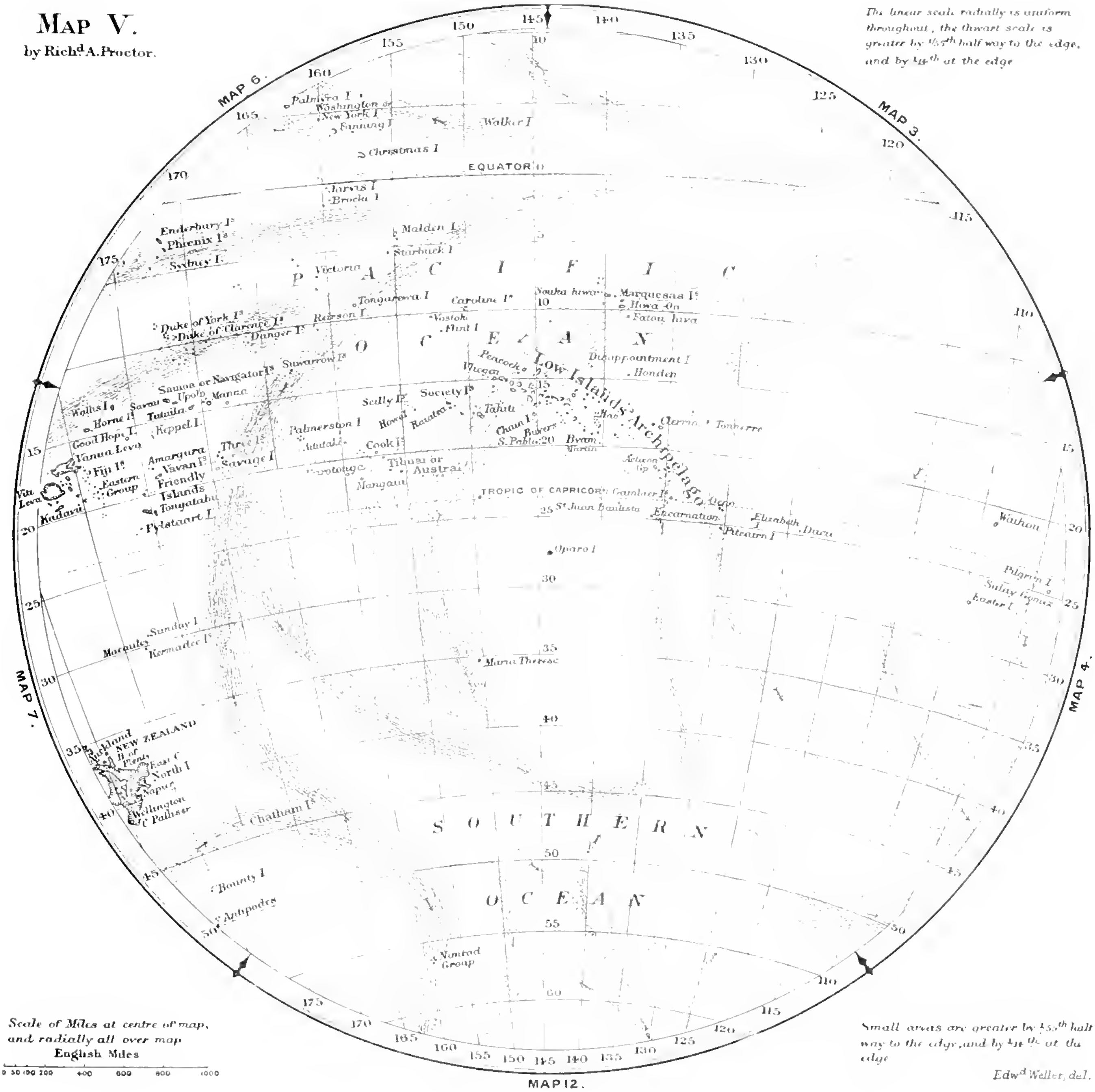


THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 46° TO 24° S.)
AND THE
SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, June 7.	At 11 o'clock, night, July 7.	At 9 o'clock, night, Aug. 7.
,, 12.30 ,, ,, June 14.	,, 10.30 ,, ,, July 14.	,, 8.30 ,, ,, Aug. 14.
,, Midnight, June 22.	,, 10 ,, ,, July 26.	,, 8 ,, ,, Aug. 22.
,, 11.30 o'clock, night, June 30.	,, 9.30 ,, ,, Aug. 3.	,, 7.30 ,, ,, Aug. 29.

STAR MAGNITUDES.

First . . . . ✵ Second . . . . ✶ Third . . . . ★ Fourth . . . . ✦ Fifth . . . . ▴



THE ONE-SCALE ATLAS.

WE give another map of this series, reserving an account of the method in which the sphere has been divided, and each map projected, till our space is less crowded.

THE WILD WINDS.

By "STELLA OCCIDENS."

GRIMM quaintly remarks in the chapter on elements in his "Teutonic Mythology" that it was quite natural to look upon "some female personages as prime movers of the whirlwind." Professor Fiske, however, tells us that in Norse mythology "it is the Devil who is proverbially active in a gale of wind." *

The first statement appears to be universally believed in Germany—at least it would seem so from the numerous legends and nursery tales in which "female personages" play an important part. In Vogtland, Northern Franconia, Thuringia, and across Lower Saxony, Frau Holda or Hulda, who may be regarded as a wind goddess, holds supreme sway. She drives about in a waggon, and flies through the air at will. She haunts lakes and fountains at noon, and at times she may be seen, a fair white lady, bathing in the sparkling water, and then disappearing under the waves, like the nymph Melusina.† Holda likewise belongs to Wuotan's "furious host," and, like Wuotan, can ride on the winds, clothed in terror, and accompanied by witches. Thus in Upper Hesse and the Westerwald, Holle-riding—to ride with Holle—is the same as a witch's ride.

At other times Holda is represented as an ugly old hag, with pointed chin, big teeth, a long nose, and bristling, thick-matted hair.‡ When she visits the pasture ground of the herdsmen she is seen dressed in a blue garment and white veil. She loves music and song under this appearance, and her lay has a doleful melody called Huldreslad. In the forests you see Holda, as an old woman, clothed in grey, marching at the head of her flock, milk-pail in hand. It is supposed that she carries off people's unbaptised children, and, according to a widespread belief, these little heathens, fell victims to Wuotan, or Holda, have thenceforth joined the "wütende Heer," or "furious host." It was also believed that Holda led an army of mice, for these were regarded as sacred animals, and were supposed to represent the souls of the little children.§

Holda also appears as queen of the mountain sprites, who are known as Huldrefolk. In Iceland they are called Huldumenn.|| Holda resembles Freya, sister of one of the most celebrated gods of mythology, and wife of Odin or Wuotan. Like Holda, Freya loved music, spring, and flowers; she was queen of the elves and water-naiads, and could fly through the air at will in a waggon drawn by two cats.¶ She also, like Hulda, is mistress of the Valkyries in general, and adopts the babes that die unchristened into their host. Freya's dwelling is named Folkvângar, which means the plains on which the (dead?) folk troop together. The cat was sacred to her, as the wolf was to Wuotan and Holda, and that is why this creature is supposed to be the favourite of old hags and witches. In some parts of Germany they say, if a bride goes to a wedding in fine weather, "she has fed the cat well"—meaning that she has not offended the goddess of love.*

In Upper Germany, in Swabia, Alsace, Switzerland, and Austria, Perchtha, a being similar to Holda, or the same under another name, is recognised. Sometimes she is represented as bright and glorious, and at other times her name is used to frighten naughty children. In olden days she had her dwelling-place between Berche and Wilhelmsdorf, in the valley of the Saale. Possibly from this arises the fact that she is sometimes called Berchta. She is queen of the "Heimchen," or little unbaptised children, whom she steals away from their homes. At her command she makes them work, and she has a great waggon in which she keeps them. Naturally the people in Saale were very indignant with her for going off with their little children, and on this account she had to leave that part of the country. She bade a ferryman await her at midnight on the banks of the river Saale. When he arrived there he saw, according to the legend, "a tall, stately dame surrounded by weeping children, and demanding to be ferried over." She stepped into the craft, and, when she arrived at the other side, she made the ferryman return for the children, who were loudly weeping and lamenting. He did so much against his will.

Another time it is related that a spinning-girl, who was walking home from Neidenberg late one night, met Perchtha marching up the hill followed by a troop of Heimchen folk, who were pushing a heavy plough and waggon in front of them, whilst the rest helped to carry tools. They were all loudly complaining because they were so tired, and had no home in which they could rest. The spinning-girl, who was in good spirits, having completed a hard day's work, and knowing that a comfortable home awaited her, laughed aloud at their misery. Perchtha angrily approached her, and blew upon her, making her blind at a breath. The unfortunate girl could scarcely find her way home, and, being unable to see her work, she soon became poor and wretched, and had to beg for a living. A year later, as she was passing over this same mountain on the eve of Twelfth Night, she heard some one approaching her, and begged for an alms. It was Perchtha, who said, "This time last year I blew out a pair of lights, this year I blow them in again." She then blew in the girl's eyes, whose sight was restored.†

In the Middle Ages, Perchtha was represented as a white lady in snow-white garments, and she appears at night in princely houses and rocks the baby's cradle whilst the nurse sleeps. At other times Perchtha, like Holda, is represented as an old hag, and is called "Dame Precht mit der eisernen Nase," or "with the iron nose."‡

But Perchtha and Holda were sometimes replaced at the witches' nightly expeditions by Herodias, regarded erroneously as the daughter of Herod, who on account of her thoughtlessness, rather than malignity, had caused the beheading of John the Baptist. It is said that when the head was brought to her on a charger, she would have covered it with tears and kisses, but it drew back, and began to blow roughly at her. The hapless maid was whirled into empty space, and there she hung henceforth for ever. Only from midnight till first cockcrow she sits on oaks and hazel-trees; the rest of her time she floats through the air.§

In the "Sachsenspiegel" there are woodcuts and plates

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* [Our fair contributor, by combining these remarks, seems to suggest an inference not wholly complimentary to her sex.—ED.]

† When Melusina leaves the castle of Lusignan, after her mermaid character is detected, she becomes a banshee. It is a common superstition among sailors that the appearance of a mermaid with her comb and looking-glass betokens shipwreck with the loss of all on board. The well-known story of Undine somewhat resembles that of the fairy Melusina.—J. Fiske, "Myth and Mythmakers," p. 96.

‡ Grimm's "Teutonic Mythology," chap. xx. p. 269: "When a man's hair sticks up in tangled disorder the peasants say, "He's had a jaunt with Holle." The description of Holda as an old hag recalls our nursery tale of the old witch "who went upon a broomstick ever so high, to sweep the cobwebs out of the sky"—generally represented as a hag with pointed nose and chin, and long teeth.

§ Fiske, "Myths and Mythmakers," p. 33. This recalls the story of the Piper of Hamlin and the fearful fate of Bishop Hatto.

|| Grimm, "Teutonic Mythology," p. 271.

¶ Bullfinch, "Age of Fable," p. 412.

* Grimm, p. 304.

† Grimm, "Teutonic Mythology," p. 277.

‡ *Ibid.*, p. 280. § *Ibid.*, p. 285.

which represent the winds, half-symbolically, as faces or heads blowing—probably a fancy of very early date. For instance, in the "Iliad," when Achilles offers libations at the funeral pyre of Patroclus, the winds, at the command of Iris, raise the flames. The gentle Zephyr and the wild Boreas made the wild tumultuous winds blow and fanned the flames; but when the morn dawned the whistling winds returned to their caves.

The Valkyries, or swan-maidens, travelled through air and water, and belonged to Wuotan's "furious host." They were warlike virgins, mounted upon horses, and armed with helmets and spears. They guided the souls of the dying on the battle-field to Valhalla, the home of Odin, where he dwells with all the Aesir or gods.* He was desirous to collect a great many heroes in Valhalla, to be able to meet the giants on a day when the final contest must come. He sent the Valkyries down to every battle-field to make choice of those who shall be slain, and hence their name, which means "choosers of the slain." When they ride forth on their errand their armour sheds a strange flickering light, which flashes over the Northern skies, making what men call the "Aurora Borealis," or "Northern Lights." †

In the Edda a legend exists about seven-and-twenty Valkyries riding through the air. "When their horses shake themselves, the dew drops from their manes in the deep valleys." In "Balder Dead," Matthew Arnold refers to the Valkyries as follows:—

> And the Valkyries on their steeds went forth
> Toward earth and fights of men: and at their side
> Skulda, the youngest of the Nornies, rode;
> And over Bifrost, where is Heimdall's watch,
> Past Midgard Fortress, down to earth they came;
> There through some battle-field, where men fall fast,
> Their horses fetlock-deep in blood, they ride,
> And pick the bravest warriors out for death,
> Whom they bring back with them at night to heaven,
> To glad the gods, and feast in Odin's hall.‡

Odin or Wuotan answered to the Greek Zeus, the Alfadir or father of all. His wife is Freya, and she is the northern Thor or Baldr, according to Cox.§ Valhalla is the great hall in which Odin feasts with the heroes who have fallen in battle. These heroes amuse themselves by fighting when they are not feasting. When seated on his throne Odin overlooks all heaven and earth. Two ravens, Hugin and Munin, rest upon his shoulders, and two lions, Geri and Freki, crouch at his feet. Odin's furious host is the storm-wind howling through the air, and supposed to be the souls of slain warriors on their way to Valhalla. Wuotan takes special delight in the rushing of his wind-host over mountains and valleys in a great gale, leading on the Pitris. These live in the sky with Zama, and sometimes shine as bright stars. In the Aryan traditions the storm-wind is a host of Pitris, or one great Pitri, who appears as a fearful giant, and in other traditions Wuotan's furious host is a pack of wolves or wish-hounds, or a single savage dog or wolf.

Wuotan has dominion over both air and water, walking on the waves and commanding the gale. In olden times they tell of Wuotan's wanderings with his waggon drawn by two wolves.

A resemblance can be traced between Hermes and Wuotan. The howling-dog or wish-hound of Hermes, whose appearance is a portent of death, and is merely the tempest personified. At night, Odin, like Hermes, was supposed to rush over treetops, accompanied by a host of dead men's spirits.*

Odin was himself also represented as a dog, and the howling wind was a great dog or wolf. "As the fearful beast was heard speeding by the windows and over the housetops, the inmates trembled, for none knew but his own soul might be required of him." In Odenwald it is believed that the passing of the Wild Huntsman is a sign of the approach of war. He is supposed to issue with his train from the ruined castle of Rodenstein, and pass through the air to the castle of Schnellerts.†

The German poet Bürger wrote a poem about Falkenberg, a keeper of a royal forest, who hunted on the Sabbath. During the chase he was joined by two huntsmen: one tried to persuade him to desist, the other led him on. At last, from amid the stormy clouds, a voice of thunder was heard saying:

> Be chased for ever through the wood,
> For ever roam the affrighted wild.‡

Helplessly the Wildgrave was whirled through the air, and this dreadful chase, according to the legend, goes on still, and will last for ever. Behind him follow the hounds and horses. When the peasants hear these sounds in the passing storm they devoutly cross themselves. Our Herne, the Hunter of Windsor Forest, referred to in the "Merry Wives of Windsor," act iv. scene 5, resembles the above.

> There is an old tale goes that Herne the Hunter,
> Sometime a keeper here in Windsor Forest,
> Doth all the winter-time, at still midnight,
> Walk round an oak with great ragg'd horns,
> And there he blasts the tree, and takes the cattle.§

In the story of the Erl-king, the father tells his child that the siren's voice is but the rustling of the wind among the dry leaves; and the Niebelung king whom the child sees is but the mist rising over the plain.

Max Müller suggests that our nursery tale of Robin Hood is only a disguise of the Northern god Wuotan.

* Cox, "Manual of Mythology," p. 281.
† Bullfinch, "Age of Fable," p. 409. Gray's ode, "The Fatal Sisters," is founded on this superstition.
‡ Bullfinch, "Age of Fable," p. 410.
§ Cox, "Manual of Mythology," p 280
‖ Fiske, "Myths and Mythmakers," p. 77.

* This recalls Erckmann-Chatrian's story of the wild huntsman, Vittiakab, and how he sped through the forest, carrying away a young girl's soul.
† It is said that the sound of his phantom horses and hounds was heard by the Duke of Baden before the commencement of the last war in Germany.
‡ Fiske, "Myths and Mythmakers," p. 32.
§ Sir Walter Scott, "The Wild Huntsman," LLs 170–1.
‖ Max Müller, "Chips from a German Workshop," vol. ii., p. 259.

NOTES ON AMERICANISMS.

By Richard A. Proctor.

Fix it, in the elegant phrase "nohow you can fix it," the use of the verb to "fix," already considered (Knowledge for March, p. 114), is seen at its best. Sam Slick first introduced the phrase, I think. But it can hardly be considered a distinct Americanism, as by Bartlett. For, granted the verb "to fix" in the wrong American sense, we must accept any possible use of the word, grammatical or otherwise, as part of the usage.

Fixings. In this word, however, we have a distinct Americanism. We have already considered the expression "chicken fixings" as distinguished from "common doings." On the general use of the word "fixings," or, as it is more commonly pronounced, "fixins," we have what is precisely akin to the use of the word "doings." There are many other examples, as in the words "going" and "coming," used as nouns, "their goings out and comings in," such goings (on), and so forth.

Fizzle. This word, used for a failure, is more commonly heard in America, perhaps, than in England; but it is only in this sense an Americanism.

Fizzle, To. To fail. This usage is also English, though the vulgarism is not so common with us as in America.

Flat out, To. To diminish in value—a Western phrase suggested by the diminished productiveness of metallic layers as they grow thinner.

Flatfooted. The significance of this word in America is very different from that of the French word *plat-pied*, identical though the words may be in their primary meaning. A French *plat-pied* is a mean, contemptible fellow; but an American "flatfoot" is a man who stands firmly for his party (and in America there is no higher praise than this). When General Grant said he had put his foot down, and meant to advance on that line if it took him all the summer, he conveyed, mixed though his metaphorical manner was, the American meaning of the expression "flat-footed." Another mixed way of using this flat-foot simile is found in the statement respecting a certain American demagogue that he had "a flat-footed way of saying things which impressed his neighbours, and was a rod in pickle for them."

Floor. To "hold the floor" is used in America as equivalent to our English parliamentary phrase "to be in possession of the House." Probably the expression had its origin in the Irish usage, "to hould the flure," applied to the longest lasting pair of dancers.

Flume. A slant passage or channel for a stream of water to turn a mill, or for gold-washing, or the like. More familiarly used in America than in England, though thoroughly English.

Flummux, To. This elegant expression, which in England means to use up, overwhelm, and generally obliterate (I think we have the elder Weller's authority somewhere for regarding it as Italian), is used in America in a different sense, meaning there to give in, faint, collapse.

Flunk. This word appears to be familiar to American colleges, signifying an utter failure in recitation—while the verb *to flunk* signifies to fail utterly.

Flunky. By no means equivalent to our English flunkey. It is applied in American colleges to one who "flunks," and in the American Stock Exchange to one who ventures to speculate without sufficient knowledge, and so comes to grief. Probably all the usages of the words "flunk," "flunkey," &c., are associated with the Low German "flunkern," to flaunt or flutter, or with the Danish "flonkeren," to glitter faintly and but for a moment.

Fly, To, off the Handle. To lose temper, get unduly excited.

Folks. The vulgarism "folks" for "folk" is common enough in England; but so much more common in America that it may almost be regarded as an Americanism. Bartlett points out the mistake which English writers make who, "in trying to imitate Yankee talk, make Americans say 'folk.'" Of course the double plural "folks" is as incorrect as "sheeps" would be, or "geeses," "mices," "mens," or "childrens."

Foreign. Americans differ from the English in their use of this word, for whereas we in England never call Americans "foreigners," Americans almost invariably apply the term to English folk. An Englishman would say, for example, of a gathering that Americans and foreigners were present; whereas an American would never think of distinguishing Englishmen in such a way from Frenchmen, Germans, Italians, and so forth. Although the population of America is seven-tenths foreign, the dislike to "foreigners" is intense, and yearly growing more so, especially among those who, though not quite the latest comers, are but one remove from being so.

Fortino, for aught I know. See *Farzino*.

Fraud. The use of this word in America is peculiar. Of course it is employed in its proper sense, to signify trickery or a trick. But it is also applied to persons and things in a sense which (*farzino*) is not known, except as an Americanism, in the old country. A person is called a "fraud," not, as Bartlett says, when he is a cheat, or at least not necessarily to signify that he is a cheat, but when he disappoints expectations. Thus an actor, of whom great things had been heard, but who should be judged not so clever as had been anticipated, would be described as a "fraud," but certainly not with the idea of attributing actual fraud to him. So a picture or a book or play which proved disappointing is called a "fraud," without attributing (necessarily) any trickery to the painter or author. In fact, the word is often applied to a landscape or other natural object or phenomenon. For instance, I remember hearing the Constellation of the Southern Cross called a "fraud" by an American who saw it for the first time under unfavourable conditions. (It always disappoints expectations unless first seen when nearly upright on the southern horizon.)

An amusing illustration of the way in which the American use of this word is commonly misapprehended in England occurred a few years ago at a meeting of the Astronomical Society. Mr. Burnham, of Chicago, the well-known observer of double stars, had pointed out a number of blunders in Admiral Smyth's "Bedford Cycle," and had spoken of the book as a "fraud," using the word in the strictly American sense. Unfortunately, it so happened that some of the mistakes were curiously suggestive of the process which schoolboys call "fudging," meaning any process by which results are made to look as if they had been fairly worked out when they have really been "cribbed." Fully persuaded that Mr. Burnham, in calling the "Bedford Cycle" a "fraud," meant to call the late Admiral Smyth a cheat, several fellows at the meeting denounced Mr. Burnham up hill and down dale. Now it is quite possible that under cross-examination he would have admitted that he did not think all the observations recorded in the "Cycle" had been really made. But to think a man not strictly truthful is one thing, to proclaim him a liar is another. Knowing the American use of the word "fraud," I thought it only just to my absent friend to point out that Mr. Burnham's calling the "Bedford Cycle" a "fraud" implied only that he had been disappointed in it. It is hardly necessary to say that in a gathering of Englishmen, only four or five of whom knew anything whatever about Americanisms, the explanation was greeted with ironical cheers, and supposed to be a mere bit of special pleading. But it was just all the same. The word "fraud," as Americans use it, no more implies (of necessity) intentional fraudulence than our English slang word "sell" implies of necessity an actual sale. By the way, the word "fraud," as thus used in America, is very nearly, but not quite, equivalent to our English "sell."

Freeze, To. To "freeze to" any one means to cling to him. The expression is equivalent to our English slang "to cotton to" any one.

Freight.—Besides its use as in England, this word, in conjunction with "car," signifies a carriage on a goods train. A "luggage van" on a passenger train is commonly called a "baggage car" in America; a "goods train" is called a "freight train," and what we ought to call a "goods car," a "goods van" (but probably railway men call it otherwise), is in America called a "freight car."

Fresh. Overbold. I have heard the word "fresh" used in this sense oftener in the South than in other parts of America.

Freshet. Bartlett is careful to explain that this word, which he describes as now only in use in America, is really old English. I imagine that our English dictionary which did not give this word would be thought a poor one.

Frisco. San Francisco is thus familiarly called in the States.

Frolic, used for a "party on a frolic," seems to be a true Americanism.

Front. In England the back of a book is the part where the leaves are held together; and if we spoke of the "front" at all we should mean the part opposite the back. But in America the "front" of a book is the beginning, and the back of the book is the end. Thus Mark Twain, in his "Interview," speaks of looking up the word in the back part of Webster's Dictionary among the pictures, where we should say near the end of the book. So an American might speak of the words beginning with A and B as occupying the front of the dictionary. The usage is a trifle absurd.

Front Name. The Christian name.

Froughy. Spongy, brittle, hence inferior in quality, as "froughy butter" for rancid butter. Commonly heard in the North of England.

Frump, To. To insult. This good old word, freely used by the Elizabethan dramatists, is still heard in New England.

Full Chisel. Full speed. Like our English slang "full split," "full swing."

Funeral. The most characteristic Americanism in connection with this word is its use in such expressions as "This is *my* funeral," meaning my special business, or, still more characteristically, "It ain't none of my funeral," meaning "It's no business of mine." There are parts of the States where "funerals" are the principal entertainments known to the public; hence they receive much attention from manager and the performers (other than the player of the principal part), and excite great interest among all classes of the community. This has led to the separation of the funeral from the burial. "Hamlet" is played without the presence of the gloomy prince; and by interposing a sufficient interval the occasion becomes one of something like merrymaking.

"DON'T!"*

A LITTLE manual of social proprieties, published under the name of "Don't!" has obtained a wide circulation; and, as its negative precepts are inspired by much good sense and good taste, we have no doubt the tiny book will prove of real value. But, while good social habits are well worth forming, good intellectual ones are at least of equal importance; and it occurs to us that there is ample room for a manual that, in a series of brief and pithy sentences, would place people on their guard against the most obvious intellectual errors and vices. Possibly the objection might be raised that, while everybody wants to be cured of his or her social solecisms (if the expression may be permitted), none so little desire to be cured of intellectual faults as those who are most subject to them. Who, it might be asked, applies the moral denunciations of the pulpit to himself? Who would apply to himself the cautions of your proposed manual? Granted, we reply, that it is easier to bring home to the individual conscience the sin of eating with a knife than the sin of reasoning falsely or acting unjustly, we should still be glad to see a telling compilation of the most needed "Don'ts" for the use of all and singular who make any profession of an independent use of their intellects. Some of the maxims would be commonplace; but then the object would not be to lay down novel truths so much as to enforce old ones. Let us throw out a few at random, by way of a start:—

Don't think that what you don't know is not worth knowing.

Don't conclude that, because you can't understand a thing, nobody can understand it.

Don't despise systems of thought that other men have elaborated because you cannot place yourself at once at their point of view.

Don't interpret things too much according to your own likes and dislikes. The world was not made to please anybody in particular, or to confirm anybody's theories.

Don't imagine that, because a thing is plain to you, it ought to be equally so to everybody else.

Don't insist on making things out simpler than they really are; on the other hand

Don't affect far-fetched and over-elaborate explanations.

Don't be overwise. Why should you make a fool of yourself?

Don't imagine that anything is gained by juggling with words or by evading difficulties.

Don't refuse to change the point of view of a question, if requested by an opponent to do so. A true conclusion cannot be invalidated by any legitimate process of argument.

Don't be inordinately surprised when a man who knows quite as much as you do on a given subject, and perhaps a little more, does not agree with you in your conclusions thereon. Try the effect of being surprised that you don't agree with him.

Don't keep on hand too many cut-and-dried theories. A foot-rule is a convenient thing for a carpenter to carry about with him; but a man who is always "sizing up" other people's opinions by a private rule of his own is apt to be a bore.

Don't be in a hurry to attribute bad motives or dishonest tactics to an opponent. Try to get an outside view of your own motives and tactics.

Don't refuse to hold your judgment in suspense when the evidence is not sufficient to warrant a conclusion.

Don't imagine that, because you have got a few new phrases at your tongue's end, you have all the stock-in-trade of a philosopher, still less that you are a philosopher.

Don't try to express your meaning till you have made it clear to yourself.

Don't argue for the sake of arguing; always have some practical and useful object in view, or else hold your peace.

Don't grudge imparting what you know, and do it with simplicity.

Don't prosecute any study out of idle curiosity or vanity. If you have time for intellectual work, be a serious and honest worker.

Don't be too eager to "get credit" for what you do.

Don't undervalue the work of others.

Here we have a score or so of maxims of the prohibitive kind, and the number might be indefinitely increased. There is no doubt the intellectual progress of the world might be hastened, and the good order and harmony of society greatly improved, if these precepts and others like unto them were more carefully observed. Whether we get another "Don't" manual or not, sensible people should think of these things, and try to bring their intellectual habits at least up to a level with their social ones.

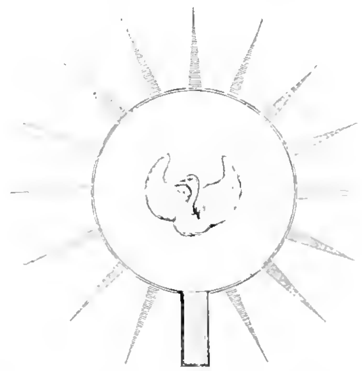
* From the *Popular Science Monthly*. A charming little article by the Editor. Some of these "Don'ts" should be printed in gold letters in our studies; for we students of science don't always remember these excellent rules.

THE JAPANESE MAGIC MIRROR.

By Dr. R. F. Hutchinson.

I HAVE, at last, realised the longings of my boyhood, and am in possession of a Japanese magic mirror. I have a hazy recollection of an attempt—I think, by Sir D. Brewster—to solve the mystery to the learned, but its effect on me was to sink me deeper in the mire of mystification. Even now, after repeated and careful experiments, I am *in statu*, and can offer no explanation of the optical mystery, nor can many to whom I have exhibited it. If you, or any of your readers, can enlighten me, I shall be deeply obliged.

I send you a rub of the back of the mirror, which will help you to understand the magic. The body is bronze, the face is said to be steel. It may be silvered,



and, as far as I can make out, is quite plane. Your face is reflected, as in any other mirror, though perhaps not so clearly as in our own looking-glasses.

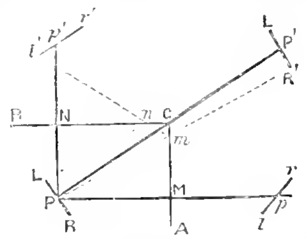
On the reverse a goose or swan is stamped out in relief, enveloped in its own plumage, and standing out about ·05 inches above the chequer-work of the ground. Now for the mystery. Reflect the sun with an ordinary plane mirror, and you obtain a replica of the face of the mirror on the wall, slightly smaller than the original. Reflect the magic mirror, and you see, not the replica of the face, but the image of the goose, surrounded by a glory of triangular rays. And, what is very strange, you do not see the image you have on the reverse, but another one altogether; thus, you see a dot on the beak, which is non-existent in the image at the back, and you do not see the drop of ink which you may place on the neck; further, you do not see the surrounding chequer-work, on the wall. Now, how is this? I cannot explain.

Another very remarkable phenomenon is witnessed on handling the mirror in sunlight. You are distinctly aware of *two* surfaces, and, if you move the mirror, the particles (?) of the two surfaces pass each other in opposite directions, like microscopic iridescent aërolites; one shown passing, say, from north to south, and the other in the opposite direction. This is very strange to see. Further, if you look for a second at the surface in the sun, *you* cannot see the bird, *but your companion sees it on your face.* The natives to whom I have shown it are amazed, and regard it as witchcraft (*jádū-gŏri*).

Another Japanese curio which I greatly value is a magnificent crystal ball, about three inches in diameter—and this, too, is great medicine to the natives, exhibiting, as it does, a lovely miniature panorama of the surroundings; but what amazes them is, that, though cold as ice, they cannot hold it in their hands in the sun, inasmuch as it burns like fury, and I often have to save it from being dropped by them like a hot potato.

OUR PUZZLES (SOLUTIONS).

Puzzle XXVIII.—When anyone looks at his reflection in a mirror, he sees himself not as his friends see him, but with his left side doing duty as his right, and his right side doing duty as his left. But suppose AC, BC to represent the horizontal sections of two mirrors at right angles, R and L the right and left side of a person, P, facing the corner C. Then there will be an image $r\ l$ as if behind mirror AC, and an image $l'\ r'$ as if behind the mirror BC. But there will also be an image R′ L′ as if beyond C (PC=CP′), and situate as shown. (The dotted line Pm nL,



shows how the point L is seen from P in direction Pm and as if at L′.) This image appears to the person himself at P, as he appears to his friends, the right side R′ facing the observer's left, and the left side facing the observer's right.

It is not necessary to have mirrors such as AC, BC. Two narrow strips of glass, supposed to be shown in section at nC and mC, will suffice to show the observer his own image, as if at P′. In fact all that is necessary in such cases is that a space should be mirrored near C so large that if this mirrored part were an opening in the wall, the whole of the observer's person set at P′ would be visible from P.

Wherever the observer may go within the space BCA he will see his image at C. If the two vertical mirrors nC and mC, which are supposed to meet in a vertical line at C, be set in rotation about a vertical axis through C, the observer at P will see his image at C during one quarter of each rotation; and if the rotation is sufficiently rapid he will see his image apparently unmoving all the time.

Puzzle XXIX.—It will be easily seen by the student that if BC, AC are two mirrored sides of a room, the horizontal ceiling of which is also a mirror, then an image will further be formed as if beyond the corner above C, and at the same distance beyond that corner that that corner lies from P. This image will be inverted. (The student will find it a useful exercise to draw lines corresponding to Pm, mn, nL in the simpler case just dealt with, showing how the various parts of the inverted image above P′ will be seen respectively on the ceiling, and on the two mirrored walls CA, CB, close by the corner.) Thus, looking at any of the top corners of the room, if walls and ceilings near those corners are all mirrored, the observer will there see his face (and figure if the mirror surfaces extend far enough) inverted. He will see the like if he looks at the four lower corners (similarly mirrored).

Thus there will be eight inverted images at the eight corners of the room, wherever the observer be situate inside the room.

Puzzle XXX.—If the twelve edges of the room (that is the places where walls meet walls, floors, and ceilings) be lined with mirrors to a sufficient breadth, the observer, wherever he be situate, will see twelve images of himself along the edges, viz. four upright in the four vertical edges, and eight inverted in the edges bounding floor and ceiling. He will further see eight inverted images at the eight angles of the room.

If the six plane faces of a room (all rectangular) be mirrored throughout their extent, an observer in the room, besides twelve images in the edges and eight in the corners, will see six images in the six faces (not to count reduplications—which can never be fully seen), or twenty-six images in all.

"THE SCIENCE OF THOUGHT," BY F. MAX MÜLLER.*

This new work of Professor Max Müller's will not find favour with such a large circle of readers as his charming "Lectures on the Science of Language," which have done so much to popularise the study of comparative philology in this country. "The Science of Thought" is a trifle too scholastic, abstract, and philosophical to captivate the general reader, but the linguistic student will find it worth studying on account of the valuable and interesting philological matter it contains. More than three hundred pages are devoted to the origin and growth of speech, to roots and formation of words.

Our author still fondly clings to the belief that we cannot think without words—"that language and thought are inseparably united." This is one of the idols of Professor Max Müller. It may be that we are *now* such slaves to words that we think in and with them, but it was not always so. And surely our own experience in this matter counts for something, in spite of the dicta of logicians to whom thought and language are inseparable. Are we not conscious of thoughts too deep for utterance, and of imaginings that soar far beyond the reach of speech? Do not our words call up thoughts and feelings of the past and produce sensations of pleasure or pain? We cannot regard language, highly as we value it as a mark of intelligence, as the only "true history of mankind." Is not language, written or unwritten, only *one* phase of mental activity? Are not works of art, inventions, &c., indications of mental growth as well as language?

The science of thought is, in our opinion, quite distinct from the science of language; each may throw light upon the other, but the genesis of the word will by no means explain the genesis of the antecedent thought. Each has its own history, and the development of the one is independent of the other. Philologists have, for the most part, left untouched the "origin of speech," and have confined themselves to the origin of roots—products of grammatical analysis—none the less real, on that account, than are the *elements* which are arrived at by a chemical analysis. We are glad to find that Prof. Max Müller is of opinion that the linguistic student should not lose sight of the beginnings of speech, but should be on the look-out for whatever may throw light upon what may be regarded as the most fascinating part of philology.

The bow-wowists and pooh-poohists get, as usual, some hard raps from the Professor, but we are rejoiced to learn "that interjections and imitations of natural sounds deserve the serious attention" of those who have to do with the origin of roots, the ultimate elements of language. In fact, he concedes more than we expected, for he is bold enough to declare the Sk. root *pûy* (in Lat. *pus*, *puteo*; Eng. *foul*, &c.) "was very likely the residuum of a number of sounds accompanying the acts of primitive men when rejecting something unpleasant and expressing their disgust."

The ding-dong theory, first started by Prof. Heyse, "that everything which is struck rings," is now given up in favour of Noiré's more recent theory of the origin of roots and concepts. "Noiré," says Prof. Max Müller, "begins his argument by pointing out a well-known fact, that whenever our senses are excited and our muscles hard at work, we feel a kind of relief in uttering sounds . . . particularly when people work together, when peasants dig or thresh, when sailors row, when women spin, when soldiers march, they are inclined to accompany their occupations with certain more or less rhythmical utterances. These utterances, noises, shouts, hummings, or songs are a kind of natural reaction against the inward disturbance caused by muscular effort. They are almost involuntary vibrations of the voice, corresponding to the more or less regular movements of our whole bodily frame. They are a relief rather than an effort, a moderation or modulation of the quickened breath in its escape through the mouth. They may end in dance, song, or poetry . . . . These sounds possess two great advantages—they are signs of repeated acts, acts performed by ourselves, and . . . . continuing in our memory as signs of such acts . . . . These sounds being uttered from the beginning, not by one solitary individual only, but by men associated in a common work and united by a common purpose, possess the great advantage of being understood by all" (p. 300–1). On p. 552 we are told that roots owe their origin to the *clamor concomitans* of our early social acts. . . . The history of language dates "from the first appearance of roots or signs of self-willed acts, because it was by these roots only that afterwards the objective products of such acts could at one and the same time be both conceived and named. . . . The very fact that roots had to be explained as sounds accompanying the acts of many people working in common, would explain the original variety of such sounds—a variety due quite as much to the actual variety of individual sounds as to the more or less delicate perceptive remembrance and power of imitation possessed by different members of the same gang. No doubt every one of these sounds was uttered at first by one individual only, for everything in the world is at first done by one individual only; but that individual must be a leader of men, and the true leader of men is he who leads while being led. From the process of leading while being led, two results would naturally follow:—If these sounds were to answer their social purpose, that is, if they were to be understood, it was necessary either that one individual sound should in the end prevail and the rest vanish, or that by a kind of friction and compromise the various sounds which had been started should be merged into one. The result in both cases would be much the same; the fittest sound would survive, the others would slowly vanish unless they could be made to answer some new and special purpose" (p. 362).

This view of Noiré's is but one aspect of the subject, and does not appear to us a satisfactory solution of the problem how men first began to speak. We may still hear men in gangs working together and uttering inarticulate sounds, but they do not appear to have any special importance in relation to language nor seem better adapted, as the first elements of speech, than other cries and exclamations. We cannot believe that speech was wanting to men until they had so far progressed as to make tools and to work in gangs or companies. Hunting would probably be as primitive an occupation as digging, but the hunter would not give utterance to his emotions if he desired his efforts to be successful. The vocable for "dig" arose long before men worked together with spades or hoes. The Sanskrit root *khan*, to dig, is an attempt to imitate the scratching or scraping sound produced by primitive man in making a hole with his fingers or with a flint or bone scraper (cf. the Sk. kha*n*akha*n*âya, to rustle—*i.e.*, to make the sound kha*n*a-kha*n*a).

Our English words *dig* and *dike* can be traced to a root,

* Longmans, Green, & Co. London. 1887.

dhigh (*dhagh*), which originally represented, perhaps, the dull sound of thumping, pounding, &c. It signifies to knead, form, mould, and to it must be referred English *dough*, Lat. *fingere*, *figura*, *figmentum* (cf. Sk. *deha*=*dhegha*, a body). The earliest and rudest sounds may have been first those natural ones that accompany feeling and sensation, then onomatopœias, rough imitations of those sounds that would naturally appeal to the ear, which organ it has been observed is far more ideal than the eye. We would, with Herbert Baynes, reverse the assertion of L. Geiger and say that "Language has sprung from the ear, from sound, and not from the eye and light." And we know very well that words like *clear*, *bright*, &c., are derived from roots that originally referred to sound. From what is *loud* we can pass on by metaphor to what is *clear* or *bright*. Our words *blithe* and *bliss* go back to a root meaning to *shine*, which again is connected with a root denoting loud noise. Such a root as Sanskrit *dhû* (of which we have allied forms in *dhuksh*, to kindle; *dhûp*, to smoke; *dhur*, *dhûrv*, to throw down; *dhâv*, to run, wash) is the outcome of a group of onomatopœic roots imitative of the howling wind, the roaring fire, rushing water and rolling stones, and the phenomena connected with them, as the shaking and rustling of trees, flashing of fire, &c. Hence such derivatives as Sk. *dhûti*, dust; *dhûma*, smoke, fume; Old Slavic *du-chŭ*, breath. It has been urged against onomatopœias that they are not fertile, and produce no offspring. It may be so *now* perhaps, because our wealth of words makes us independent of this mode of adding to our vocabulary. But an onomatopœic vocable had formerly a numerous progeny. Take, for instance, the root *bhla* (*bhlad*); from this have sprung the English words *blow*, *blabber*, *bladder*, *blast*, *blare*, *bluster*, *blood*, *bloom*, *blossom*, *bloated*—cf. Latin *flare*, *flatus*, *flumen*, *flos*, *flamen*; Greek, φλέειν, παφλάζω, φλαυρός, &c. If we look at one of Professor Max Müller's roots (119*a*, p. 631) denoting "noise (inarticulate)," we shall find it by no means unproductive.

A Sanskrit dictionary gives us numerous derivatives of the root kruç, among which we note words for reviling, pitying, lamenting. The same root furnishes us with names for jackal (kroshtu) and osprey (ut-kroça).

In Sanskrit, a highly developed and literary language, and in many respects very artificial, we find abundant remains of onomatopœic roots, which are only a small sample of what one finds in any of the *living* Hindu dialects descended from Sanskrit. We find, however, in Sanskrit *kû*, *kûj*, cry or sing as a bird; *kuñj*, to rustle; *guj*, *guñj*, to buzz; *ghu* (*ghu-r*, *ghu-s*), to utter a deep sound; *ghurughurâya*, to snore, whistle; cf. Marathi *ghu-ghu*, the hoot of the owl or pigeon; *ghor*, the death-rattle (Sk. *ghora*, terrible), a swollen river, frightful, &c.

But we need not go on to multiply instances of the onomatopœic element in language. We have ample proof of its existence and influence. We need not be ashamed of it—though we may indeed marvel that such a wonderful work of art, as language undoubtedly is, has sprung from such rude beginnings. It renders, however, what, at first sight, seems wonderful and mysterious, simple and intelligible.

Prof. Max Müller ably defends the fundamental principles laid down by Bopp as against the followers of the new school of Comparative Philology. He discusses many interesting points connected with the old theory that some suffixes contain "elements of independent significance." Our *upward*, turning or bending up, he compares with the Sanskrit *ud-ak*, which has the same meaning, from the preposition *ud*=*up*, and the root *añc*, to bend. He has a very long discussion on the suffix *tâti* (Lat. *-tas*, Eng. *-ty*), the conclusions of which are by no means convincing.

In taking leave of our author, we only hope that he may have health and leisure to write the other "treatise" he proposes to give to the world, namely on "the Self that seems to see and seems to think"—and "Who that Self is.'

Gossip.

BY RICHARD A. PROCTOR.

A CORRESPONDENT writes us a letter beginning—

Dear Sir,—Matter is spirit, is it not? Or what is spirit, or what is matter?

and so forth. I ask in answer simply—not, I fear, in the right spirit—Does it matter?

* * *

A CORRESPONDENT rebukes me for regarding it as a mere superstition that after a misdeal there will be a singleton among the hands next dealt—because "he feels bound to regard it as a fact, though depending on a law not yet understood." In other words, he does not happen to have noticed any case when, after a misdeal, there has not been one singleton at least among the hands next dealt. No amount of such experience, however, would prove that to be a fact which in the nature of things cannot be. On the contrary, a single experience to the contrary proves that the supposed fact is no fact: and I have observed at least a score of cases in which there has been no singleton in the deal following a misdeal. Science cannot, however, deal seriously with any idea involving the sequence of an event as if *caused* by another, when, in the nature of things, there can be no causation.

* * *

PLAYING without shuffling, or with very little shuffling, there will be fewer singletons, as there will be fewer irregular hands, than when the cards are freely shuffled—and for very obvious reasons. When the cards are taken up after a hand has been played they are in tricks, and among the tricks a considerable number have all the four cards of one denomination. Any such trick not separated by shuffling, will in the next deal give one card of the same suit to each player, and so will diminish the chance that any player will get but one card of that suit. A few undivided tricks will greatly diminish, then, the chance that any player will get a singleton of any suit.

* * *

WHEN, however, the deal following the misdeal is from another pack the chance of a singleton cannot be increased or diminished by the misdeal, through the operation of any law, understood or misunderstood—*unless* the interruption of the play leads to a fresh and extra-thorough shuffling of the pack to be used for the next deal. Such shuffling to some degree increases the chance of a singleton, and it is to be remembered that the odds are always greatly in favour of a singleton occurring, except when the cards are scarcely shuffled at all, when as the play proceeds there is a decided tendency to equally divided hands.

* * *

A CORRESPONDENT inquires why I removed the chapter on "Other Universes" from Guillemin's Heavens as revised by me; and my opinion on the statements as to the distance of certain clusters in that chapter. I regard these statements as without any foundation whatever in fact, and I removed the chapter because I thought—or rather, I *know*—that we have no sort of evidence in regard to external galaxies.

* * *

Serious illness in his family, and resulting anxieties and losses, prevent the Editor from devoting so much attention as usual to "Gossip" this month. For a like reason no new puzzles are given, as the Editor has not had time to devise any which seemed suitable. Hereafter "Mathematical Recreations" will take the place of the Puzzles.

* * *

The undersigned feels sure that Mr. Proctor's many friends will be grieved to hear that a deep shadow has fallen on the home which he has temporarily pitched in America in the loss of two children, one of them a bright and charming boy of five years, through that terrible slayer of the Innocents—scarlet fever. These columns offer a convenient place for our expression of sympathy with Mr. and Mrs. Proctor and their family. Edward Clodd.

Reviews.

Overwork and Premature Mental Decay: its Treatment. By C. H. F. Routh, M.D. Fourth Edition. (London: Baillière, Tindall & Cox. 1886.)—Reading through Dr. Routh's eminently plain, sensible, and practical essay, we do not wonder that it has already reached its fourth edition. In our existing condition of incessant toil after wealth, position, and pleasure, with men and women essaying to accomplish three or four times the amount of work done by their grandfathers and grandmothers in the same time; with our extraordinary facilities for rapid locomotion, and with our purely artificial condition of existence, what wonder if the overwrought machine gives way, and the originally strong man becomes the veriest wreck of his former self? How and why this result supervenes, and under what treatment its victim may be restored, Dr. Routh here tells us, and his little book may be commended as a thoroughly trustworthy guide to all upon whom worry and care are in any degree beginning to tell.

Alexander's Empire. By J. P. Mahaffy, D.D., with the collaboration of Arthur Gillman, M.A. (London: T. Fisher Unwin. 1887.)—Nothing probably is more familiar to the student of history than the story of the succession of victories by which the mighty Macedonian subjugated so large a proportion of the then known world; but the manner in which the different parts of his dominion waxed and waned until they were finally swallowed up in that *edax rerum* the Roman Empire, is by no means so well known. It is, then, to the elucidation of this that the narrative of Professor Mahaffy is addressed. By far the most interesting part of his work is that in which he traces the influence of Hellenism on the conquered peoples, and shows to what an extent it dominated the ideas of Rome itself. In this connection chapters xiv., xx., and xxxii. may be singled out as well worthy of study. With reference to the chronicles of the numerous wars into which the members of the once consolidated empire plunged, we fear that they will require more sustained attention than the larger proportion of readers will be either able or willing to bestow. In fact, so confusing are the iterations and reiterations of certain names, that Doctor Mahaffy thoughtfully concludes with a "List of Names easily confounded." The illustrations, of which there are no less than forty-four, are one and all apposite, and show the perfection to which Greek art attained in architecture, sculpture, and numismatics.

The Deviation of the Compass in Iron Ships. By W. H. Rosser. Second edition. (London: Jas. Imray & Son. 1887.)—It has been known certainly ever since the twelfth century that a magnetic needle, so balanced as to play horizontally about its pivot, points more or less approximately to the north according to the part of the world in which the observation is made. In fact, the Chinese claim to have employed it in navigation from a period of the hoariest antiquity. Now, as long as the directive force actuating the needle resides solely in the earth itself, the phenomena exhibited are sufficiently simple, and the compass is a comparatively trustworthy instrument; and as this condition of things obtained in effect as long as ships were built of wood alone, the compass has for centuries been an aid of priceless value to the navigator. But with the substitution of iron and steel for wood in shipbuilding a total change has taken place in the circumstances under which the compass is employed; for every iron ship that is built becomes herself a gigantic magnet, with the direction of its polarity dependent upon the position which the vessel occupied with reference to the magnetic meridian during the time she was being built, with the result that the most remarkable deviations are found in the infinitely less powerful magnets of the compasses on board. In Mr. Rosser's excellent work the methods of ascertaining the exact amount of deviation of the compass on board of an iron ship, both on an even keel and when heeling to any extent, of the mechanical methods of correcting such deviation, and of the tabulation of residual errors at all azimuths, are lucidly laid down and explained in language which must be intelligible to every one competent to navigate a vessel at all. Whether for sea use, for the Board of Trade examination, or for the professional compass-adjuster, no more useful or intelligible book than the one before us has, so far, been published.

Shoring and Its Application. By Geo. H. Blagrove. (London: Crosby Lockwood & Co. 1887.)—Here is another excellent and thoroughly practical volume on a subject, the importance of which in connection with public safety can hardly be over-estimated. Within the compass of eighty-nine pages, Mr. Blagrove deals with the whole art of shoring, from its simple application in preventing the fall of old and decaying walls and partly destroyed houses, up to the complicated devices for the support of such structures as St. Alban's Abbey and Beverley Minster. Our author has made a distinct and valuable addition to the literature of the building art.

Messrs. Longmans send us an excellent *Geographical Reader* adapted for the Seventh Standard; and we have also to acknowledge the current number of their magazine, of which "Allan Quatermain" is the attractive feature; also of the *American Naturalist*, in which the valuable papers on the "Significance of Sex" are completed.

Our Whist Column.

By "Five of Clubs."

The following game was played recently at Melbourne. The whist editor of the *Australasian* played hand Y. The point of the game lies in the play by Y of a small diamond at trick 2. It will be seen by his notes that Y considers the play, though unusual, to have been justified by the position. I cannot but think he risked the loss of the game by passing. This opinion is not based solely on the error in calculating chances into which Y fell, as his notes show. That error, by the way, is very natural. It was made by the well-known mathematician, D'Alembert (when, however, the mathematics of chance problems was as yet in its infancy), in dealing with the toss of a coin. There are three events, he said: two heads, two tails, and one of each; therefore the odds are two to one against the last. They are in reality even, because one of each may occur in two ways—head tail or tail head.

THE HANDS.

B { S. (*trumps*).—Kn, 8, 6, 5, 2. H.—8, 6, 5, 4. D.—10, 7. C.—10, 6. }

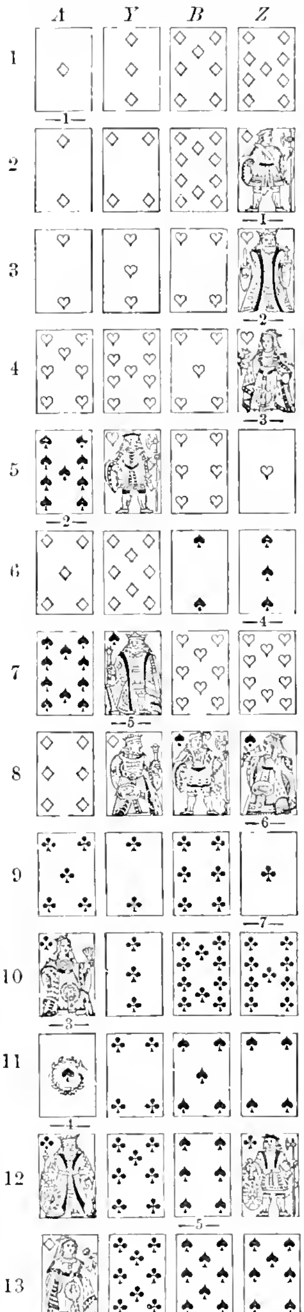
Y { S. (*tps*).—K. H.—Kn, 9, 3. C.—8, 7, 4, 3, 2. D.—K, 8, 4, 3. }

B
Y Z
Tr. S. 4.
A leads.

S (*tps*).—Q, 7, 4, 3. H.—A, K, Q, 10. C.—A, Kn, 9. D.—Kn, 9. } *Z*

A { S (*trumps*).—A, 10, 9. H.—7, 2. D.—A, Q, 6, 5, 2. C.—K, Q, 5. }

A B play against *Y* and *Z*. Score :—*A B* four; *Y Z* four.
Card underlined wins trick; card underneath leading next.



And *Y Z* win the odd trick and the game.

Notes by the Whist Editor of the "Australasian."

Trick 1.—At the end of this trick *Y* knew that there were at most two Diamonds of unknown comparative values, to distribute between *Y* and *Z*. The only possible arrangements were :—*B* two Diamonds, *Z* none; *B* one, *Z* one; *B* none, *Z* two. Consequently, on the assumption that *A* led from five Diamonds, the odds were two to one that *B* or *Z* was void of the diamond suit. Again, in case that the distribution turned out to be one Diamond with *B* and one with *Z*, it was exactly an even chance that *Z* would be able to win the trick. Of course *Y* was bound to bear in mind the contingency that *Z* had begun to call for trumps. But with the score at four all strong trumps in *Z*'s hand would win without his resorting, on the first opportunity, to a call for a trump lead.

Trick 2.—Without reference to the wisdom or otherwise of the adoption generally of the system of American leads, *A* ought to have played the diamond five rather than the Diamond two. For by leading the Diamond two he practically relieved *Y*'s mind of all doubt as to whether *Z* had or had not begun at Trick 1 to call for trumps. *Z* was right in playing the Diamond four. For on the contingency that one or other of the two players behind him was void of the Diamond suit, it was an even chance it would be *B* who would trump; and on the other contingency that there was a Diamond in each of the hands, it was also an even chance, as has been already pointed out in the note on Trick 1, that *Z* would be able to win the trick. Again, if *Y* had put on the Diamond king and won the trick, he could not have led a Club from a suit of five headed by the eight. He must have led the Heart knave. But with his weak cards he wanted guidance from *Z* as to what to do in the interests of the combined hands. Besides, in any case he blocked the opponent's suit, and this was pretty well all the help he was able to give towards winning the game.

Trick 3.—*Z* had four trumps, together with Club ace and the complete command of Hearts. Also the command of Diamonds was with *Y*. Consequently at this stage of the game the Spade three looked like the best lead.

Trick 6.—*A* very naturally placed the Diamond eight with *Y*, and the Diamond king with *Z*. But as the event proved, both these cards were with *Y*.

Trick 8.—*Y* now played the Diamond king with deadly effect. *B* properly trumped with the knave, not with the eight, because he wished to puzzle *Z* as to the position of that card. But as the Club ace was with *Y*, the game was lost to *A B* at the next trick.

One of Mr. F. H. Lewis's published games, which has been reproduced in *The Australasian*, admirably illustrates the point of keeping back the best card of a plain suit. But in that example the necessity of that line of action was not developed till near the end of the play of the hand, while in the preceding hand the possibility of having to resort to it was suggested to *Y* at the end of the very first trick.

Notes by "Five of Clubs."

Tricks 1 and 2.—*A* is evidently not a believer in the American leads, according to which the five should have been led second round. *Y*'s play of the four, where usually the best card would be played second round, is the point of the game. Holding the eight himself, he knows, from the play of *B* and *Z* to the first round, that only ten, knave, and queen can possibly be held by *B* or *Z*, unless one or other is signalling; and from *A*'s lead, indicating five Diamonds in *A*'s hand, *Y* knows that only two of these high cards (it matters little which two) can be between *B* and *Z*—possibly but one. (There must be one, and, if one, it must be either queen or knave, since otherwise *A* would not have followed with the small card.) In the more probable event that two cards lie between *B* and *Z*, it is an even chance that one or other is void. For calling these cards knave and ten, the possible arrangements, all equally likely, are :—*B* holds both, *Z* none; *B* holds knave, *Z* ten; *B* holds ten, *Z* knave; and *B* holds none, *Z* both. If there is only one Diamond between *B* and *Z*, it is, of course, an equal chance that *B* or *Z* holds it. It is an even chance, in all events, that *B* or *Z* can take the trick, supposing *Y* plays his small card. At the score I cannot recognise the expediency of keeping back the king to block *A*'s long suit. The odd trick is apt to depend on other considerations. I should have played the king, and, on the fall of the other two Diamonds, have led the Diamond four, enabling *Z* to ruff under favourable conditions. The 4th, 5th, and 6th tricks would thus have been identical with the 3rd, 4th, and 5th in the actual game; and *Y Z* would have needed only three tricks to make the odd. If *A* had gone on with the Diamond queen, *Z* would have captured her, leading a Heart for *Y* to win by overruffing *A*; and the ace of Clubs would have made the odd trick sure. If *A* had led Club king, it would have fallen to *Z*'s ace, *Y* would have overruffed Hearts as before, and leading a Diamond, *Z* would have made the odd trick by ruffing. *Y* could not know that *Z* could thus support his strategy; but I submit that this is the right sort of strategy for securing the odd trick. Had the play been for or against bringing in a long suit, *Y*'s holding back the king might have been justified.

Trick 3.—At the score the lead seems just.

Trick 5.—Here, I think, *Z* should have led trumps (holding length in them). The odds are in favour of *A* being able to ruff, as he certainly holds three Diamonds, whereas *Y* cannot hold more than two. Forcing the enemy is certainly not *Z*'s game at the score.

Trick 8.—*Y* plays his best Diamond effectively, but not more effectively than he might have played a losing Diamond at Trick 3, had he taken Trick 2 with his king.

The best proof that *Y* gave up some of his chances by playing the small Diamond may be seen in the play of the game when the Diamond knave and ten are interchanged. It is obvious that had *B* held the knave *Y*'s actual play would have lost the game. But the plain strategy I have suggested above would have won the game even in this case, as the following play shows :—

	A	*Y*	*B*	*Z*
Trick 1. . .	D A —1—	D 3	D 7	D 9
" 2. . .	D 2	D K —1—	D Kn	D 10
" 3. . .	D 5	D 4	C 6	S 3 —2—
" 4. . .	H 2	H 3	H 4	H K —3—
" 5. . .	H 7	H 9	H 5	H Q —4—
" 6. . .	S 9 —2—	H Kn	H 5	H A
" 7. . .	C K	C 2	C 10	C A —5—
" 8. . .	S 10	S K —6—	H 8	H 10
" 9. . .	D 6	D 8 &c., &c.	S Kn	S Q —7—

THE FACE OF THE SKY FOR JUNE.

By F.R.A.S.

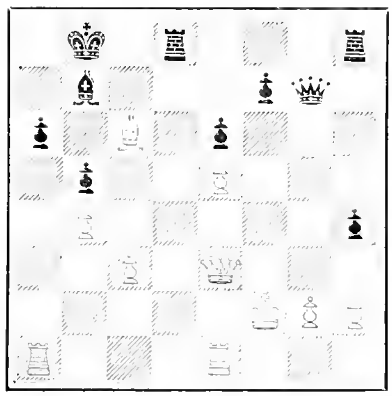
THE sun may be watched for the isolated spots which have somewhat unexpectedly begun to reappear at intervals on his surface. The night sky will be found depicted on Map VI. of "The Stars in their Seasons"; but there is no real night during the entire month in any part of the British Islands, twilight persisting from sunset to sunrise. From the 19th to the 22nd in London the sun will be 16h. 34m. above the horizon. Mercury is an evening star throughout June, and does not set until nearly 10 o'clock at night about the 18th, at which date he may be easily detected with the naked eye after sunset over the N.W. by W. part of the horizon. Venus is also an evening star, and is the most brilliant object in the sky. As it happens, she sets at her latest (11h. P.M.) about the 18th, the same date that Mercury does. Her figure in the telescope is now approaching that of the Moon when in her first quarter. Mars is invisible. Jupiter is approaching the west, and must be looked for as soon after sunset as he is visible. He will be found to the E.N.E. of Spica Virginis ("The Stars in their Seasons," Map V. or VI.). The certainly visible phenomena of his satellites of course decrease in number. On the 4th Satellite III. will be occulted 49 minutes after midnight. On the 5th Satellite I. will begin its transit at 11h. 58m. P.M.: as will the shadow it casts at 12h. 55m. On the 6th the same satellite will reappear from eclipse at 12h. 18m. 33s. P.M., as will Satellite II. subsequently at 12h. 54m. 29s. On the 7th the egress of the shadow of Satellite I. happens at 9h. 36m. P.M. On the 13th Satellite II. will be occulted at 10h. 49m. P.M., as will Satellite I. afterwards at 11h. 0m. On the 14th the egress of Satellite I. from Jupiter's disc will occur at 10h. 27m. P.M., its shadow following it at 11h. 31m. On the 15th the egress of the shadow of Satellite II. takes place at 10h. 7m. P.M., and the ingress of the shadow of Satellite III. at 10h. 26m. The latter will pass off Jupiter's opposite limb twenty minutes after midnight. On the 21st Satellite I. will begin its transit at 10h. 5m. P.M., followed by its shadow at 11h. 13m. The visibility of the egress of the satellite is very doubtful. On the 22nd Satellite III. will enter on to Jupiter's face at 9h. 39m. P.M. Then the ingress of the shadow of Satellite II. will happen at 10h. 7m., the satellite casting it passing off the opposite limb of the planet at 10h. 21m. At 10h. 36m. 7s. Satellite I. will reappear from eclipse; and at 11h. 45m. Satellite III. will leave the disc of Jupiter. On the 29th, the transit of Satellite II. begins at 10h. 12m. P.M.; and finally, on the 30th, the shadow of Satellite I. will pass off at 9h. 50m. P.M. Saturn, for the observer's purpose, has left us until the autumn. Uranus may still be picked up immediately the twilight is deep enough to the S.W. of γ Virginis; but he is very near to the horizon. The Moon is full on the 5th at 10h. 38·3m. P.M.; enters her last quarter at 1h. 34·8m. P.M. on the 13th; is new at 10h. 52·8m. A.M. on the 21st, and enters her first quarter at 10h. 1·0m. A.M. on the 28th. Five occultations of fixed stars by the Moon will occur during June at convenient hours for the observer. On the 2nd, 94 Virginis, a star of the 6th magnitude, will disappear at the dark limb of the Moon at 8h. 29m. P.M. at an angle from her vertex of 335°. It will reappear at her bright limb at 8h. 39m. P.M. at an angle of 319° from her vertex. On the 4th, 49 Libræ, a 5½th-magnitude star, will disappear at the dark limb at 7h. 55m. P.M. at an angle of 345° from the vertex of the Moon. It will reappear at 8h. 30m. at her bright limb, at a vertical angle of 284°. On the 5th, 29 Ophiuchi, of the 6th magnitude, will disappear at the dark limb at 8h. 52m. P.M. at an angle from the Moon's vertex of 60°. The Moon, however, will be so nearly full that the effect will be that of a disappearance at her bright edge. The reappearance at her really bright limb occurs at 9h. 59m. P.M. at an angle of 224° from her vertex. On the 6th, B.A.C. 6081, of the 6th magnitude, will disappear at the bright limb at 8h. 40m. P.M. at a vertical angle of 20°, reappearing at the dark limb at 9h. 39m. at an angle from the vertex of 258°. Lastly, on the night of the 10th, 45 Capricorni, of the 6th magnitude, will disappear at the Moon's bright limb at 11h. 49m., at an angle of 42° from her vertex: to reappear at her dark limb 53 minutes after midnight at a vertical angle of 275°. At noon on the 1st the Moon is in Virgo, across which she is travelling until 3h. A.M. on the 3rd, when she enters Libra ("The Seasons Pictured," plate xxvi.). She remains in Libra until 10h. P.M. on the 4th, at which hour she arrives at the boundary of the narrow northern spike of Scorpio. She has traversed this by 6h. 30m. the next morning, and emerged in Ophiuchus, her passage through which is completed by 9h. P.M. on the 6th, when she crosses into Sagittarius. She is in Sagittarius until 5h. 30m. A.M. on the 9th, and she then enters Capricornus ("The Seasons Pictured," plate xxi.). Her journey through Capricornus ends at 7h. A.M. on the 11th, when she crosses the boundary into Aquarius, and she quits Aquarius in turn for Pisces at 10h. A.M. on the 13th ("The Seasons Pictured," plate xxii.). It is not until 4h. P.M. on the 16th that she has traversed this great straggling constellation and entered on the northern confines of Cetus. She leaves this outlier of Cetus at 6 o'clock the next morning, and enters Aries. By 10 A.M. on the 18th her journey over Aries is completed, and she passes into Taurus ("The Seasons Pictured," plate xxiii.). As she travels through Taurus, she reaches, at 4h. 30m. A.M. on the 21st, the edge of the northernmost portion of Orion. It takes her just 12 hours to cross this, and she then emerges in Gemini ("The Seasons Pictured," plate xxiv.). She continues in Gemini until 9h. 30m. A.M. on the 23rd, at which hour she enters Cancer. She passes from Cancer into Leo at 9h. 30m. P.M. on the 24th, and is in Leo until 10h. A.M. on the 27th, when she passes into Virgo ("The Seasons Pictured," plate xxv.), and this she quits in turn for Libra at 10h. A.M. on the 30th, her passage across the whole width of Virgo thus occupying exactly 72 hours ("The Seasons Pictured," plate xxvi.). She is still in Libra at midnight on the 30th.

Our Chess Column.

By "Mephisto."

POSITION in a game played in a handicap tournament at the British Chess Club, White having received the odds of two moves at starting.

L. Hoffer.
Black.



White.
Wainright.

White played

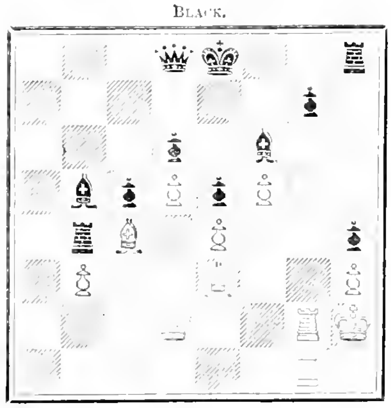
R × P	R to Q7 (ch)

If B × R, then Q to Kt6 (ch) would win.

Q × R	B × R
Q to Q6 (ch)	K to B sq
R to QR sq	R to Q sq
R × B	R × Q
P × R	Q to B3 (ch)
K to Kt sq	Resigns.

Position in a game played, at the odds of two moves, between Messrs. Mills and Gunsberg.

I. Gunsberg.
Black.



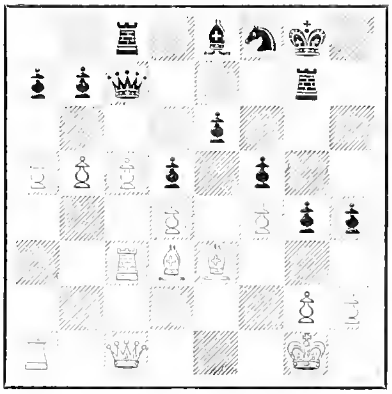
White.
D. Y. Mills.

As may be seen from this position, Black was too intent upon gaining an advantage on the Queen's side, and did not sufficiently heed his opponent's doings on his K side, the result being that White now won as follows:—

B to Kt5	K to B sq
Black had no satisfactory move.	
B × B	P × B ?
Q to R6 (ch)	Resigns.

Position, after the forty-first move, in the second game of the match Blackburne *v.* Zukertort, played at the British Chess Club, May 9, 1887.

BLACKBURNE.
BLACK.



WHITE.
ZUKERTORT.

The game proceeded in the following very interesting manner:—

42. P to R6 !	P to Kt3

The alternative moves of P × P. 43. R × P would have led to a loss by a slow process, as White would three times attack the black RP, which could not be effectively defended.

43. P × P

Both White and Black must have expended a good deal of thought on their last moves. Black has no alternative now but to accept the consequences.

	Q × R
44. Q × Q	R × Q
45. P to Kt7	R × B

Kt to Q2 would not prevent the Queening of the Pawn, as White would reply to this with P to Kt6 !

46. P (Queens)	R × B
47. P to Kt6 !	

All this is very fine and strong, and the reader must be puzzled to know how such a game can be lost.

	P to Kt6
48. Q × B	P × QKtP
49. P to R3	

49. P × P was much simpler, and created less of a block if R(K6) × P then R to R2, and advances the QRP.

R to QB2

Taking the best advantage of the position, and threatening to come down with his Rooks as a last desperate chance, especially as the Kt effectively protects the K against the Q.

50. Q to Kt8

White should not have allowed Black to double his Rooks on the 7th row, as then the game becomes very difficult. Two moves can be played by White—either 50. Q to KR5 or Q to QR4 ; the former would most likely lead only to a draw, whereas the latter holds out good hopes for a win.

R to R6 !

This move must have been overlooked by White, who probably calculated on R to B7 ; 51. P to R7, R to K7 ; 52. Q × Kt (ch) ; K × Q ; 53. Q(Queen) (ch) and wins.

51. R to KBsq

A bad move on any consideration. Black's intention to double his Rooks on the 7th file by R to B7 and R7 is too obvious to be overlooked, therefore the R should not have blocked in the K if 51. R to Kt sq ; then Black would probably draw by R to B7, 52. P to R7, and then either Rook to R7 should draw

	R to B7
52. Q to Q8 ?	QR to R7
53. Q to Kt5 (ch)	K to B2
54. Q to R5 (ch)	Kt to Kt3
Resigns ?	

Undoubtedly Black has conducted the ending exceedingly well under very difficult circumstances, but although he has gained a considerable advantage through White wasting time with his R and Q, there was *no occasion at all* for White to resign immediately; on the contrary, he still had some good chances of playing for a draw. We can only account for White's resignation in a match-game that he must have been under the impression that Black could force a mate, which, however, is not the case. It is no good playing 55. Q to B3, for Black would answer with Kt × P !—winning. But supposing

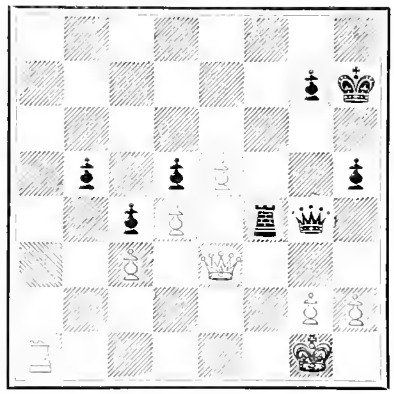
55. R to K sq	R × P (ch)
56. K to R sq	

and we see absolutely nothing else for Black but to endeavour to win by capturing White's KBP.

There are many other lines of play possible, most of which, however, lead to a draw. In some instances even White threatens to win by R to QB sq; as, for instance, if Black plays R to R7 (ch), 57. K to Kt sq, R × P, 58. R to QB sq. There is also the P on R6, which would aid White; and, considering the difficulties and chances of practical play, White's game was, as Mr. Gunsberg pointed out, by no means hopelessly lost.

Position in the third game of the match, played May 11, 1887.

ZUKERTORT.
BLACK.



WHITE.
BLACKBURNE.

Zukertort played	P to Kt5 ?
P to R3	Q to Kt4
R to K sq !	

And White must win, for he cannot be prevented from advancing his KP.

	P × P
P to K6	P to B7
P to K7	R to K5
Q × Q	R × R (ch)
K to B2	Resigns

For if P (Queen's), then White plays Q × Q, and wins.

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LONDON: JULY 1, 1887.

RELIGION AND THE UNKNOWN.

By RICHARD A. PROCTOR.

Behold God is great and *we know him not*. . . . Great things doeth he which *we cannot understand*. . . . Touching the Almighty *we cannot find him out*.—*Elihu* (*the approved of God*) *in the Book of Job*, chap. xxxvii.

Who hath known the mind of the Lord?—*Paul* (*to the Romans*), chap. xi.

IN a kindly notice of my essays on "The Unknowable" in KNOWLEDGE, which I saw recently in *Watts's Literary Guide*, the remark is made that though I "object to the term 'agnostic' as inadequately expressing my views," I am "in sympathy with those who are recognised as belonging to the agnostic school of thought." I am not sure that I have ever expressed any objection against the term "agnostic," though I admit that no such term can quite adequately express the views of a school; but emphatically I am in sympathy with the school called, for convenience of reference, Agnostic. I wish here briefly to show why; and more particularly to point out that in all ages and among all races true and reverent religion has been necessarily agnostic.* I have expressed this thought in KNOWLEDGE in the words, "A God understood is no God at all." I might equally have said, with the same underlying meaning, "A religion which may be presented in terms of the known is *no* religion."

So soon as man rose above the merely animal condition he began to be moved by the unknown and by the unknowable, though as yet he had no means of distinguishing one from the other. He showed the influence of the unknown upon his emotions by the constant effort to picture it as known and understood. In this effort religion had its beginning and all developments of religion had their origin. What was nearest and simplest moved man first. The river and the forest, the mountain and the sea, rain, wind, and storm, representing unknown and for the child-man unknowable power, were early regarded as known deities, only mysterious in their attributes as deities, in their nature and qualities, their will and purpose. Men recognised in the very unknowableness of natural phenomena the known fact that in these, at any rate, they might worship a power outside themselves—in other words, Deity. But as time went on, as the life of the huntsman and the fisherman gave place to pastoral life—nomadic first, and then more settled—and pastoral to agricultural life, the forces with which man had just come into more obvious contact, the forces belonging to *the earth*, lost in dignity and impressiveness in presence of the forces which seemed present in *the heavens*. The sun in his glory and his obvious might, the moon walking in splendour, the planets as they pursued

> Their obvious course, now high, now low, then hid,
> Progressive, retrograde, and standing still,

began to be recognised as the really mysterious powers of the universe. These now seemed appropriate objects of worship and adoration, because their movements and their influences seemed inexplicable, and being thus apparently unknowable might be regarded as assuredly divine. Men now, as before, in what seemed certainly unknowable, found certainly known divinity. And because this way of viewing the heavenly orbs necessarily lasted for many centuries in every race, for thousands, nay, tens of thousands of years among mankind, the worship of these mysterious divinities—mysterious, yet in the very assurance of their mystery regarded as demonstrably divine, affected all races which passed beyond a certain stage, to the very heart's core. No matter what advance might subsequently be made, no race has ever *as* a race, shaken off that long established religion which had the dome of the heavens for its temple, the visible orbs of heaven for its deities. In the temples of to-day, among Jews, Mohammedans, Christians, and Buddhists—anxiously though the teachers of these religious bodies have endeavoured to get rid of nature-worship—the ceremonial observances relating to the heavenly bodies remain. Our temples now bear to the great temple of the sky the same sort of relation which the Lady Chapels of the Middle Ages bore to the great cathedral beneath whose roof they found a place.

In the worship of the heavenly bodies, there was the worship of the unknown, and, as was thought, the unknowable. So soon as the movements of these bodies were known and could be predicted they ceased to retain their position as deities, except for the ignorant, who, however, were the many, as they have ever been. Here began, as the ignorant supposed, a contest between science and religion. Science attacked religion, as they understood religion, in the very fact that science endeavoured to explain what, so long as it was believed to be inexplicable, men could worship. Science destroyed the significance and value of their sacrificial system so soon as science learned to predict that at such and such a time the sun would rise again, the moon which had waned would refill her orb, the sun as God of the year would ascend, after his spring passover, to the full glory of the midsummer heavens. Men cannot worship the vernal equinox or the sun's right ascension, as they had worshipped the sun-god at his passover, or after he had ascended to the mid heaven. The "Nautical Almanac" cannot replace the greater and the lesser prophets; nor can tabular announcements of sunrise and sunset, of the moon's quarters, or of the equinoxes and the solstices, take the place of the morning and evening sacrifices, the "blowing of the trumpet in the new moons," the Feasts of the Passover and of Tabernacles, or the Fast of the Atonement for the waning of the sun-god. Observation has displaced observance, study has displaced reverence, so far as the religion of the heavenly orbs has been concerned. There was in a sense a long-lasting conflict between science and religion, as knowledge displaced nescience, and men found that what they had deemed an inexplicable mystery—the veritable unknowable—could be interpreted and understood. But it was because the worship of the heavenly bodies was no true religion that conflict arose with growing science, and that grown science slew the religion which was based on false conceptions.

* With this volume of KNOWLEDGE the papers and notes on the relations between religion and science which have appeared in KNOWLEDGE from the time of its issue as a monthly magazine, will be brought to a conclusion. They will probably be collected soon in book form.

So long as religion attempts to deal with the unknown as the absolute unknowable, and fixes its domain within the mistaken limit thus drawn, conflicts must ever be renewed with growing science, and the event of such conflicts must be ever the same. When religion ceases to proclaim that "Deity is here, or It is there," and admits that the force lying at the back of all phenomena, Absolutely Unknowable Power, can alone be accepted as the truly divine mystery of the universe, then and then only the advance of science will become (as it should be) a matter of no moment so far as religion is concerned. When men pictured Hell as the lower story, Heaven as the top story, of a world whereof the middle story was the earth, science, in showing the earth to be a mere point in space, was shaking the very foundations of religion. But that was because religion was based on falsely-assumed knowledge. If science is shaking the foundations of religion now, it can only be for a similar reason. True religion has no more occasion to fear science than the infinite has occasion to fear astronomy.

THE STAR OF BETHLEHEM.

By Richard A. Proctor.

FEW things perplex me more than the fanciful way in which the general public take up some matters of scientific interest and neglect others. Although my real work lies in scientific study rather than in the exposition of scientific matters, I am considerably interested in studying the manner of thought of those whose avocations are for the most part unscientific. And repeatedly I have been surprised, not to say disappointed, by the lax attention of the public in regard to matters which to the student of science appear intensely interesting, and the earnestness, almost enthusiasm, with which the same public will consider matters relating, indeed, to science, but in which the student of science will hardly consent to take any interest at all, so trivial are they, or uncertain, or unfruitful.

Amongst the matters about which I have received the greatest number of inquiries I may mention specially what the unscientific choose to call the Star of Bethlehem. I am not referring now to the celestial appearance recorded as seen in the East at the time of the Nativity—a subject already dealt with fully in these columns. I am considering a certain new star seen in the year 1572, which persons ignorant of astronomy insist on calling, without a shadow of real reason, the Star of Bethlehem. I know not to whom the honour of inventing this ridiculous title for the star should be assigned. Probably one those semi-religious, but wholly ignorant fanatics, who look to the heavens for signs and portents relating to the affairs of men, and imagine that the fires which are presently (they assert) to destroy this sinful earth will come straight down on us from the celestial canopy over our heads, conceived the brilliant idea. But, whoever first thought of it, the idea has been received with enthusiasm by kindred minds; and such minds being much more numerous than minds more reasonable, the notion is found knocking about all over the world, in company with an amount of ignorance about even the elements of astronomy which is truly distressing in its bewildering completeness.

The latest development of the preposterous notion that a remote variable sun in Cassiopeia, probably at least a million times further from us than our own sun, is the same orb which led the astrologers of Chaldea first to Jerusalem, and then, after disappearing for a time, from Jerusalem to Bethlehem (an eight miles' walk) has now been announced. A "professor"—bless us !—of Hartford, Ky., has actually seen the new star in Cassiopeia, close by the point overhead, a little towards the north. Astronomers will be more startled by the position assigned to Cassiopeia than by the discovery of a new star in that well-known constellation. Any one could look at Cassiopeia and imagine—being ignorant—that some perfectly well-known star in that constellation is a new one. In fact, this Kentucky "professor," by remarking that there are five bright stars in Cassiopeia, "and two or three others," shows clearly enough what oddly incorrect ideas he has about the array of stars in that compact but tolerably rich constellation. What is really stupendous in his achievement, is not his seeing a new star in Cassiopeia, but his seeing Cassiopeia in a new place. Could Cassiopeia be seen at night in the middle of May towards the zenith, most assuredly the discovery would merit most serious attention. For such a portent would imply much more serious trouble than the appearance of a whole legion of new stars. An old constellation (and Cassiopeia is very old) appearing in a new place, would imply very serious terrestrial disturbance. If the astronomers we pay to keep track of time by close survey of the stars—our Government astronomers, I mean—had to report Cassiopeia now as in the zenith, at any time between nightfall and morning twilight—matters would look unpleasant indeed. Old earth would have to wobble from her true position in fearful fashion to bring about such a portentous phenomenon as that; for, as a mere matter of fact, Cassiopeia ought at midnight in May to be nearer the horizon than the point overhead. It has been suggested that the miracle of the standing still of the sun can only be explained, for modern science, by the staying of the earth's rotation during a certain interval, the earth resuming her steady spin when the Jews had done their fighting; to which the sceptical crew who are always suggesting troublesome doubts, have objected that if the earth stopped rotating, every earthly thing would have been destroyed by the shock, and consumed immediately afterwards by the tremendous heat instantly generated. But this would be nothing compared with the significance of the Kentuckian professor's miracle. For this would require not merely such a trifle as that the earth's spin should be stopped and presently started afresh, but that the actual position of the polar axis should be affected.

The question arises whether we may not reject the Kentuckian's miracle, even though his announcement is prophetically worded. When we read in "King Solomon's Mines" of a solar eclipse which remained total for half an hour, to say nothing of its occurring a day after the moon had been full, which again occurred a day after the moon had been "new," we do not feel bound to accept the series of miraculous phenomena as the theologian accepts the standing still of the sun and moon for the accommodation of Jewish fighting folk. May we not in like manner suppose that the professor of Kentucky has made a trifling mistake? To put the matter plainly, may we not transfer our wonder from the details of his sensational announcement to the blatancy of his remarkable ignorance.

To speak seriously, the Kentuckian professor, in his holy zeal to be the first to proclaim the appearance of the Star of Bethlehem, has permitted himself the privilege of untruth. Doubtless he was, and is quite, certain that the star is due this current year; doubtless also he imagined that the star may begin to be visible to very keen eyesight some time before it becomes obvious to all. If the star really has a message for mankind, as no doubt the Kentuckian professor supposes, a man must be doing good service to the world who gets beforehand with the star and starts the message a little sooner than the star could manage it. Picture the professor's state of mind with these ideas possessing him, and that perfect freedom of imagination which comes from sheer ignorance. How can he possibly carry out his idea better than by telling the world he has seen what Tycho Brahe actually saw? He turns, therefore, to the oft-repeated narrative of the discovery of the new star in 1572. Tycho Brahe saw the star in Cassiopeia; there, then, must the Kentuckian professor see it. Tycho Brahe saw the star near the zenith, so that Cassiopeia manifestly lodges overhead; there, then, our professor must see her. In unfortunate ignorance of the fact that a constellation which is near the zenith in November (Tycho Brahe first saw the star on November 11) is bound to be a long way from the zenith in May, our Kentuckian prophet saw Cassiopeia overhead, when she was really near the horizon; saw a new star where no new star existed, and—to speak in the language of the profane—developed a series of untruths until all outside was azure. Mr. Lockyer's achievement in telling little learners where the stars which pass overhead in London rise and set—stars which never come within a score of moon-breadths of the horizon—was nothing to the feat of this Kentuckian professor; for Mr. Lockyer only implied that he thought those stars might rise or set: our Kentuckian religionist tells us he actually saw Cassiopeia overhead, when she was in reality low down near the horizon.

But it may be asked whether, though this particular charlatan has not seen Tycho Brahe's star, that orb may not soon resume the abnormal splendour with which it shone in 1572 and 1573. This is possible (so many things are possible), but the evidence which led Goodricke to suppose that the star is an irregular variable, with a period averaging 312 years, is so slight that no astronomer would give much for the chance that Tycho Brahe's star will return to visibility this century, or perhaps for many centuries. In Tycho Brahe's time, a Bohemian astronomer (Cyprianus Leovitius was his highly respectable name), stated that in an old manuscript he had found records of the appearance of a new star between Cassiopeia and Cepheus in the year 945, and of another—or the same star—similarly situate in 1264. Even at the time much doubt was thrown over the account of these stars, several astronomers regarding it as probably relating to comets. But Tycho Brahe accepted the account as relating to stars, and considered that the object seen might possibly have been the same which blazed out so brightly in 1572.

That is absolutely all the evidence we have! Assuming the statement of Leovitius not wholly apocryphal, as some have not hesitated to assert that it was, we have statements about two bodies which may have been comets, but possibly were stars appearing in a tract of the heavens described as between Cassiopeia and Cepheus, a tract which must be assumed to be very broad indeed if it is to include the place of Tycho Brahe's star, in the years 945 and 1264—the intervals, if these were indeed apparitions of that orb, being 319 years and 308 years. This cannot be regarded as absolutely demonstrative evidence that Tycho Brahe's star is a variable blazing out, like a revolving signal light, at average intervals of 312 years, as Goodricke supposed, or 315 years, as others have suggested.

But even if, which is quite possible, the small star now under telescopic scrutiny for a quarter of a century because astronomers believe it to be Tycho Brahe's should blaze out suddenly with a lustre akin to that which it displayed in 1572, we may be well assured that the display, however interesting to astronomers and physicists, will not otherwise be a matter of the slightest moment for the inhabitants of this earth. To associate the idea of the systematic variation of some remote sun with remarkable events upon this little earth of ours, is to exhibit such an absence of all power of just reasoning as unfortunately characterises too many among the unscientific. It would not be possible to argue men out of such a belief, who, by the very fact that they have entertained it, have shown that sound reasoning (in such matters) is impossible for them. But as a mere matter of fact, the idea is as wild in its absurdity as would be the thought that the fortunes of a race of insects inhabiting a New Zealand tree must be affected by the systematic flashing out of the Eddystone Signal Light on the other side of the earth.

FREAKS OF THE WIND.

By Henry J. Slack, F.G.S., F.R.M.S.

NATURE often exhibits on a small scale actions which on a large one produce enormous effects. Thus when a heavy shower sweeps along the sand and gravel of a garden-path we have a miniature representation of what great floods do in transporting boulders and drift; and when tiny runnels cut a zigzag way through soft soil, being easily deflected by small obstacles, we have a copy of the way large rivers flow. With winds it is the same. The strong gales and cyclones which tear up trees, overthrow houses, and overwhelm ships, are sometimes represented by small aerial disturbances of a size that can be conveniently studied. The writer on one occasion, when driving home from a railway station, saw in front of him a shifting sand column about twenty feet high, small at the bottom and widening as it went up. It moved, rotating dancingly from one side of the road to the other, and fell to pieces as the vehicle passed swiftly by. If it had fallen on the travellers they would have been unpleasantly dusted, but innocent as its small power would have made it, as an illustration of the great dust-storms of the deserts it was better than any picture, because it was all alive with characteristic motion.

On a March day of the present year in South Devon a brisk strong wind from the north-east gave for many hours what may be called miniature rehearsals of the curious gyrations often performed with terrible consequences on a grand scale by wind and sea. The scene was on the top of the Down of Babbicombe, where in front of some terraces, and across a road of common width, is a long strip of grass constituting a favourite promenade, as it commands an extensive curving line of cliffs and shores of all colours, from crimson marl to pearly marble, yellow sand, and white chalk. In fact, it is the view of the coast from Oddicombe to Portland Bill. The wind came across some miles of sea. Part of its current may have rushed up the rocky cliffs, about 270 feet high; another part probably came straight to the grassy plain, and the two may have conflicted. Also some rebounding currents may have come back from the row of houses.

What happened was exhibited by sundry pieces of paper, small biscuit bags, and other reminders that light refreshments had been taken on the spot. The same pieces of paper were made to perform all day in a space of some thirty or forty yards long, and half that width. Moreover, they never mounted high in the air. Any one would have thought that a strong blast from north-east would at once have carried them off south west, but it did nothing of the kind. A glance at the pennon on an adjacent flagstaff showed the wind generally true to its north-east line of approach, but it went all ways on the grass. Frequently pieces of paper, of about the same size and shape, and only a few feet apart, were carried simultaneously in opposite directions. Sometimes two or more pieces went round in circles; at others, two of the biggest hopped rapidly about each other like lively birds at play, but none rose many feet from the ground. It frequently happened that the velocities of their movements varied considerably beyond what could have resulted from impacts of air-currents of the same force upon objects differing slightly in size, weight, and shape. It was plain that the wind moved in narrow streams, varying in velocity, so that objects a few feet apart received blows of very different force.

I cannot remember distinctly enough for exact reference where I saw an account of experiments which illustrated this behaviour of a wind-storm. So far as I can recollect, screens of small dimensions were placed in line, and so arranged as to record the force of the wind impact. The result showed that the air-currents struck the screens much as if a quantity of balls, big and little, had been hurled at them.

Storms of very limited breadth are known to be of common occurrence, and while disastrous damage has been done to trees and buildings within a few yards of each other, adjacent objects have had no strain put upon them. What the wind at Babbicombe did was to imitate over and over again this sort of action on a minute scale.

Probably in all violent cyclones it is a mere chance whether any of the usual anemometers happen to receive and indicate the extreme force with which some part of a much larger object would be struck. Some years ago a storm of small breadth in its most violent part overthrew my observatory, made of wood strengthened with T iron and covered with stout canvas, while no damage was done to trees a few yards off. An anemometer near the trees would not have indicated anything like the force which lifted up and carried forward the observatory.

It would be well worth while to erect in some situation exposed to storm-winds a screen representing a section of a house or bridge, and arranged like the one mentioned, in registering compartments. We might thus obtain a better idea of the forms and the forces of wind currents, and of the resisting power required for safety.

FORCE AND ENERGY.

ALTHOUGH so frequently used by scientific and unscientific writers, the words "force" and "energy" are constantly confounded. I find many misinterpreting, on this account, passages in which the words are used. It may, therefore, be worth while to indicate the sense in which these words are to be understood in accordance with the meanings now definitely assigned to them in scientific writing. They should, in reality, be no more confounded as thus used than gravity and heat—gravity is, indeed, a form of force, and heat a form of energy. Force is any cause by which motion is produced or modified. A force in thus moving or modifying motion does work. The work stored up, as it were, in a body, through the action of a force upon it, is called *energy*. If I throw a stone into the air I exert force upon it; the velocity I communicate to it represents the work done upon it, and this velocity possessed by the body, at the moment when it leaves my hand, represents the energy of the mass which, before I threw it, had been inert. The energy possessed by the body may seem to vary, and actually does vary, but not quite so much as it appears to. It varies because owing to the resistance of the air the energy of the body is continually being diminished; but the energy thus lost by the body is transmitted to the air. But the further loss of velocity on account of the earth's attraction retarding the velocity of the body which had originally been thrown upwards, is not a loss of energy, for the change of place involves a corresponding increase of what may be called energy of position, and this velocity will be presently restored as the attraction of the earth draws the stone down again. In imparting velocity to the stone, again, I was not increasing the stock of energy in the universe; for by whatever upward action I drove the stone from the earth, I correspondingly (regard being had to the relative mass) urged my own body towards the earth, depriving my body of just as much energy of position as corresponded with the energy I imparted to the stone. Energy is, in fact, akin in one respect to mass—it may be taken from or imparted to a body, or from a system, or imparted thereto; but its totality can never be altered, any more than the total amount of matter in the universe can be altered.

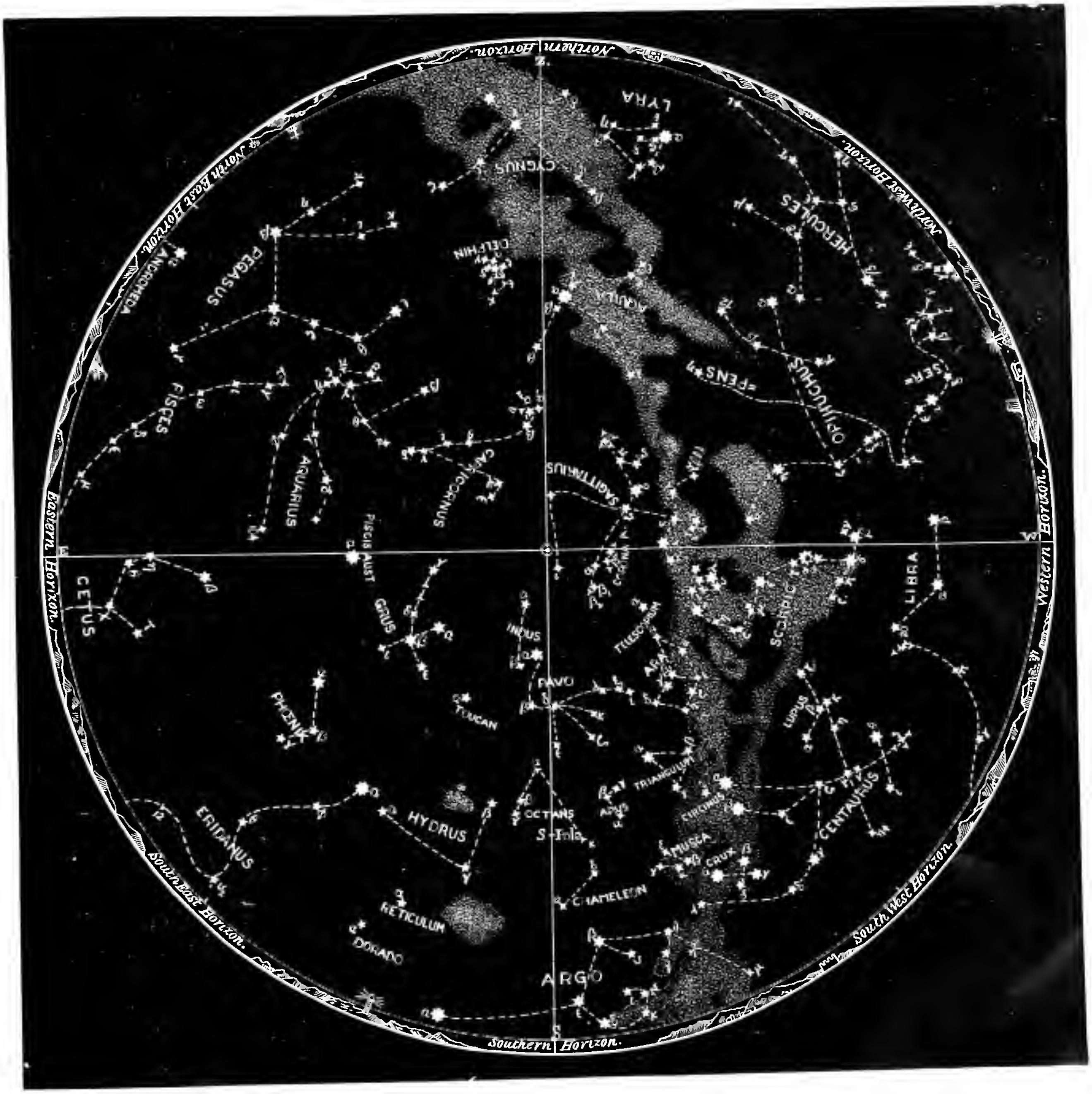
It has been stated that with regard to these words "force" and "energy" science has no settled usage, but there is no foundation whatever for this statement. The use of the words has long been definitely fixed in scientific treatises. Those unfamiliar with mathematical and physical science are very apt to misuse both words, as also to substitute for one or other words which have no such definite scientific use —as power, might, influence, and so forth. But *abusus non tollit usum*, the abuse of anything, as Guy Mannering puts it, doth not abrogate the lawful use thereof.

Probably the confusion which has arisen among outsiders respecting these two words "force" and "energy" has been caused in great part by the varying inter-relations of force and energy as cause and effect at one time, effect and cause at another, though, indeed, one ought rather to say that they appear at one time as following and antecedent, at another as antecedent and following, respectively. Yet, in reality, we must regard energy as the true antecedent, seeing that in its fullest sense energy is (as defined by Rankine) the capacity to effect changes. When force is exerted, energy, as we have said above, is stored up somewhere in precise proportion to the exerted force: but that force was itself the product of pre-existing energy. Nor do we ever recognise force which has not in some way been generated by the exertion of some form of energy, though, as in the case of the attraction of gravity, we may be unable to say what that form of energy was, or how it may have been exerted.

Doubting Faith.—Of old it was held to be a dangerous thing to inquire too closely into the nature and origin of the earth on which we live. Men might inquire, though only with caution, into the natural processes taking place around them; into the growth of plants and animals; or into the origin of winds, rivers, and other such phenomena. It was not held, for example, to be an obvious sign of Atheistic tendencies to discuss the development of a tree from the seed, or to trace the progress of a river from its source. But a warning voice was heard so soon as inquiries were pushed a little farther. If observant men, for instance, were led to examine the formation of a river-valley, and thence to inquire under what forces that valley had assumed its present form, they were told that they were pushing their queries beyond the verge of what man was suffered to understand. Worthy people in those days seem to have laboured under a continual fear of discovering too much, of coming unexpectedly upon the operation of a first cause. They seem to have felt that as Moses took off his shoes when he approached the bush, so it behoved them to proceed cautiously and as with unshod feet, lest unwarily they should light on evidence of the direct action of the Creator's fashioning hand.

THE SOUTHERN SKIES.

MAP IX. FOR JUNE, JULY, AND AUGUST.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 16° TO 21° S.)
AND THE
SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, July 7	At 11 o'clock, night, Aug. 7.	At 9 o'clock, night, Sept. 6.
,, 12.30 ,, ,, July 14.	,, 10.30 ,, ,, Aug. 14.	,, 8.30 ,, ,, Sept. 14.
,, Midnight, July 26.	,, 10 ,, ,, Aug. 22.	,, 8 ,, ,, Sept. 21.
,, 11 30 o'clock, night, Aug. 3.	,, 9.30 ,, ,, Aug. 29.	,, 7.30 ,, ,, Sept. 29.

STAR MAGNITUDES.

First ✵ Second . ★ Third . . . . ★ Fourth ✦ Fifth ⅄

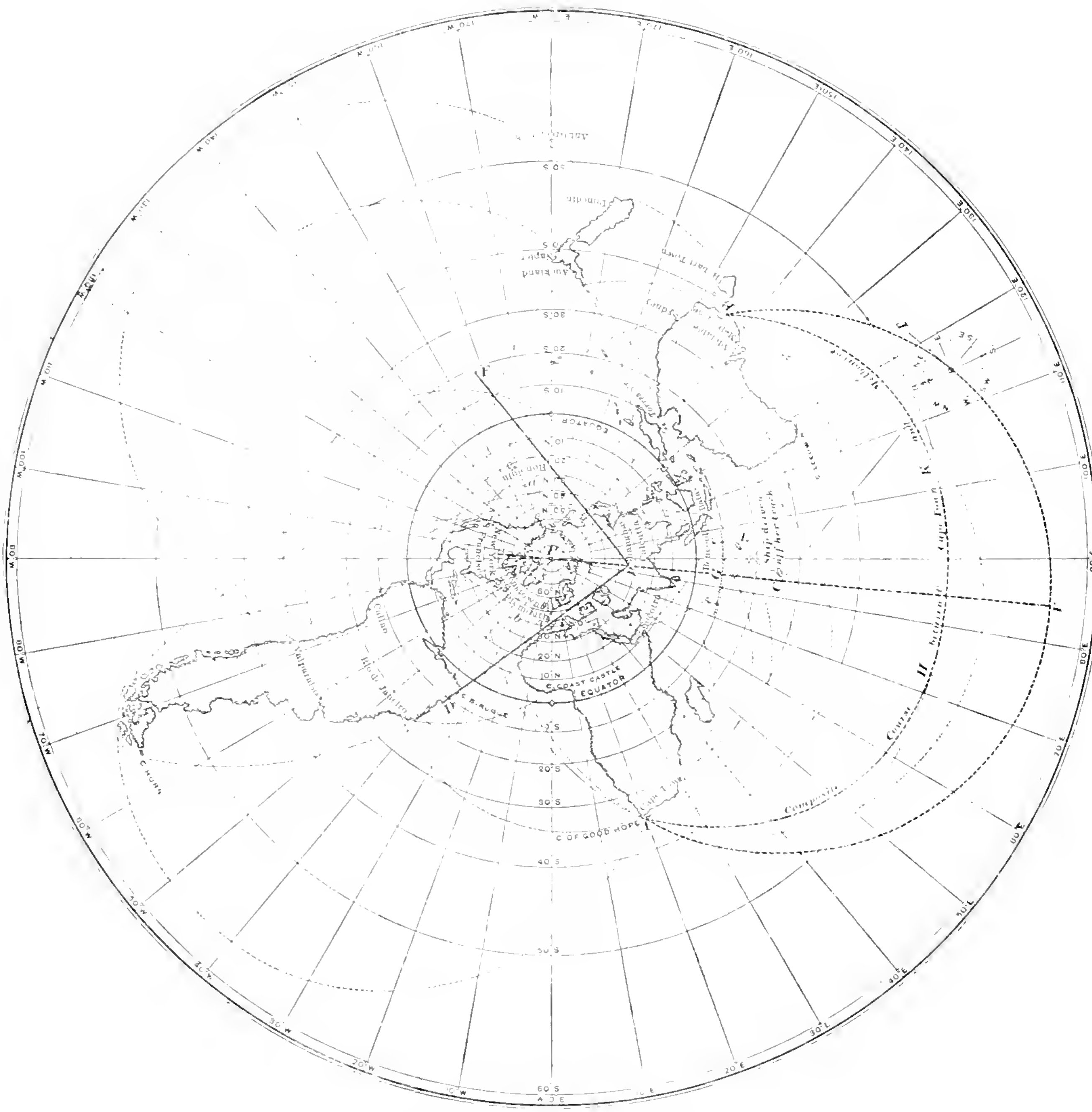


Chart for Great Circle Sailing.

Showing more than thirty great circle tracks and illustrating the constructions for one case—Cape Town to Melbourne.

By Richard A. Proctor.

QUARTER OF THE SOUTHERN CHART on the same Projection (and on the same scale), showing fourteen illustrative great circle tracks in the North Atlantic, obtained by the same method. [L and K mark the points where the steamships from Queenstown and from Bordeaux respectively cross the Newfoundland Bank.]

HOW TO USE THE CHART

I. To find the *great circle course* between two places, A and B.

Describe a circle through A, B, and *a* the antipode of A (or through A, B, and *b* the antipode of B): it will pass through *b* (or *a*) and be *the great circle required*.

II. To find the *vertex* or highest latitude reached.

A straight line through the pole and the centre of AB*ba* cuts this great circle in *the highest latitude point required*.

III. To find the bearing at any point of the course.

The course cuts the Meridians at angles *showing the true bearing*.

IV. To find the *composite course* between A and B, touching lat. *l*.

With radius equal to half the distance, across pole on chart, between north-latitude *l* and south-latitude *l*, describe arcs through A and B touching lat. *l*; these arcs, and part of lat. parallel (*l*) between them, make up *the composite course required*.

V. To find the great-circle distance between A and B.

Find *p* the pole of the great circle course (90° in lat. from vertex), and centres D and F of great circles through A*p* and B*p*; then *the great circle course AB contains as many degrees as there are in the supplement of DpF, each degree containing* 60 *geographical miles.*

NOTE.—If a ship is driven from her course, as from L to C, the great circle course from C (as CA) is found by I.

EXAMPLE.

To find I., the *great circle course*; II., *its vertex*; III., the *bearing* (*at any point*); IV., the *composite course* (*lat.* 50); and V., the *distance*; from Cape Town A (antipode *a*), *to Melbourne B* (*antipode b*).

I. Find C, the centre of circle through A, B, *a*, *b*, and describe, round C, *the required great circle course* AVB.

II. Through P, C, draw PC*e*V', giving the *vertex*, V.

III. Draw compass-card N-E-W-S about O, NS meridional, then OT, tangent to course, shows the *bearing at O*.

Note.—Angle EOT = angle NOC.

IV. Bisect *vv'* (lat. 50 N & S) in G; *about* P describe arc *eGe'*; with radius G*r* and centre on *ee'*, desc. arcs AH, BK; AHVKB is the *required composite course*.

V. Take *p* on PV, 90° from V; find D, the centre of a circle through A, *p*, and *a*: and F, the centre of a circle through B, *p*, and *b*; *AVB contains as many degrees as the supplement of the* angle *DpF*. By measurement with a protractor, AVB contains 92¾°, corresponding to 5,565 geog. miles. True distance 5,566⅚ geog. miles (587 geog. miles less than Mercator's course).

CHARTS FOR GREAT CIRCLE SAILING.*

SHOWING AT ONCE THE GREAT CIRCLE TRACK, THE COMPASS BEARING AT EACH POINT, AND THE DISTANCE; ALSO THE "COMPOSITE COURSE" TOUCHING ANY GIVEN LATITUDE.

By RICHARD A. PROCTOR.

THE shortest distance between any two points on a globe is the lesser arc of the great circle passing through them (a great circle on a sphere being one whose plane passes through the sphere's centre). But the seaman, in passing from port to port on the earth, generally follows what is called a rhumb line—such a track that he has the same compass course (apart from magnetic variation) throughout his journey. Mercator's projection, on which the charts of the world in our books of geography are drawn (I mean those charts which show the whole world), was invented to help the sailor in marking his true rhumb course from port to port, this course being shown in Mercator's charts as a straight line. In long journeys, however, especially such as are made in the southern hemisphere, the rhumb course is far longer than the great circle course. For instance, from Cape Town to Melbourne the course on a rhumb line is 587 miles longer than the course on the arc of a great circle. Even in such a journey as from Queenstown to New York (where, however, the great circle track is broken by the Newfoundland shores, and two arcs have to be combined) there is a considerable saving of distance in following the great circle route. Moreover, for sailing vessels tacking against adverse winds the saving is far greater. In tacking along a rhumb course, sailing as close to the wind as she can, a sailing vessel is often actually increasing her distance from her haven. In passing from the English Channel to New York, on a rhumb course, against adverse winds, a sailing vessel tacks over 7,360 miles; but taking the great circle course, the distance traversed in all her tacks would be only 6,490 miles, a saving of 870 miles, or five or six days' sailing for a craft of medium speed! On some of the long South Sea journeys, where the difference in miles between the rhumb course and the great circle course may be seven or eight hundred miles, the actual difference of distance traversed in tacking against adverse winds would amount to two or three thousand miles!

My present object is to show how charts may be made which will be as convenient for great circle sailing as Mercator's charts are for sailing on a rhumb line.

Two difficulties have checked the extension of the system of great circle sailing. In the first place, a process of calculation has to be gone through to determine even the proper *first* course for great circle sailing, that is, the bearing at the port of departure; and a fresh calculation has to be made for a succession of points—usually taken five degrees in longitude apart—along the great circle course. Secondly, it often happens that the true great circle course would carry a ship into inconveniently high latitudes.

To meet the first difficulty, various methods have been from time to time suggested for obtaining graphically the great circle course. Sir George Airy invented a most ingenious but unfortunately a complicated construction for drawing the great circle course on a Mercator's chart. Mr. Hugh Godfray, the author of the Cambridge text-book on the Lunar Theory, suggested the use of the gnomonic projection, where the great circle course is represented by a straight line, just as the rhumb course is represented on a

* This article is mainly a reprint from the *Scientific American*, from whose pages the illustrations have been reduced.

Mercator's chart; and various approximative constructions have been suggested from time to time.

To meet the second difficulty, Mr. Towson, of Liverpool, suggested composite sailing, by which a great circle course is taken from the port of departure to touch the highest latitude deemed safe, and another great circle course is taken which, touching that highest latitude, passes through the port of arrival: the journey pursued is along the former great circle course to the limiting latitude-parallel, then along this parallel till the second great circle course is reached, and thence along the latter great circle course to the desired haven. Mr. Towson published also a valuable series of tables for facilitating the calculation of the composite course from port to port. The Rev. George Fisher, chaplain of the Greenwich naval schools, devised a graphic method for approximating to the composite course on a Mercator's chart.

These methods of calculation and of construction have not come into general use. It has been found impossible to introduce the general use of great circle sailing as hampered by these requirements, especially in the case of sailing vessels, where fresh calculations or constructions, by no means simple, would have to be made whenever a ship had been driven out of her course by stress of weather.

A chart on which the great circle course between any two points can be at once laid down would obviate these objections. And at first sight it seems as though Mr. Godfray's proposition met this want; for, as I have said, the great circle course on a gnomonic chart is a straight line. But a gnomonic chart cannot show even a full hemisphere. The point of projection is at the centre of the sphere, as shown at O, Fig. 1, the projection being made on a tangent

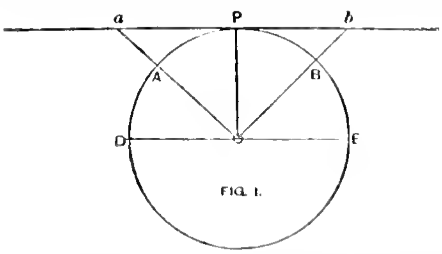


FIG. 1.

plane as aPb. Supposing one of the poles to be at P, the centre of the projection, the points A and B would be projected at a and b respectively. The points D and E could not be projected on the plane aPb at all. The scale of the chart increases rapidly from P outward, becoming infinite for points 90 degrees from P. The projection then, though it might serve for ports in one hemisphere, is evidently not available generally. Moreover, the gnomonic projection would not indicate the bearing (anywhere on the course), the vertex, or the distance.

Instead of this practically useless method of constructing charts for great circle sailing, I propose the use of the stereographic projection, whereby (1) the construction for marking in the great circle course between any two points is made exceedingly simple; (2) the whole course is obtained at once; (3) the "bearing" at each point of the course is shown as plainly as the bearing of the rhumb course on a Mercator's chart; (4) the "composite course" where wanted can be obtained by a simple construction; and (5) the distance from point to point can be easily determined.

I need not here discuss the principles of the stereographic projection at any length. I will simply note those points which make the projection convenient for the proposed purpose.

In the stereographic projection of the sphere, the point of projection O, Fig. 2, is on the surface of the sphere, at the extremity of a diameter PCO, through P, the centre of projection. Thus if d P f represent the tangent plane through P, the points A and B on the sphere would be projected on d P f at a and b, where OA and OB produced meet d P f. If D and E are 90 degrees from P (as in

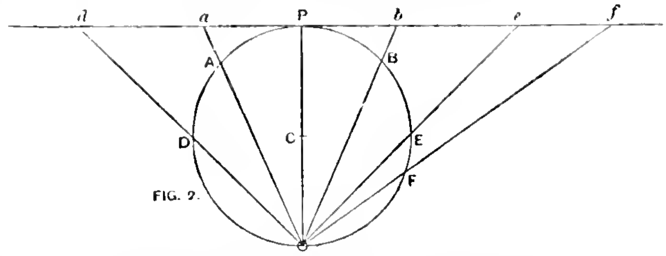


FIG. 2.

Fig. 1), their projections fall on d P f at d and e. A point as F, still nearer to O, will be projected on the tangent plane as at f.

If P be either pole, the projection of the sphere on the plane d P f is a very simple matter; for all the meridians are projected into straight lines through P, and all the latitude-parallels into circles around P as centre. The radii of these circles can be obtained by construction, as shown in Fig. 2. But in practice it is far better to use their known lengths as indicated in trigonometrical tables. Thus if PB is an arc of 60°, we know that the angle POB contains 30°; so that P b is equal to PO tan. 30°. Thus, for the parallels corresponding to latitudes 85°, 80°, 75°, and so on, we take from the trigonometrical tables the natural tangents of $2\frac{1}{2}°$, 5°, $7\frac{1}{2}°$, and so on; and these numbers, with any convenient unit of length, give us the radii of the circles we are to describe round P. For instance, if we wish the equator to have a radius P e (equal to PO) five inches in length, we draw a line five inches long, divide it into ten equal parts, and one of these again into ten parts (or preferably make a plotting scale for the smaller divisions); then regarding one of the tenths of the line, *i.e.*, one-half an inch, as our unit, we take, for our successive radii, lines having the following lengths:

For latitude	85°	0·437	which is the tang. of $2\frac{1}{2}°$
"	80°	0·875	" 5°
"	75°	1·317	" $7\frac{1}{2}°$

and so on. Then a series of radial lines drawn to divisions 5° apart round any one of these circles give the meridians, and complete our projection. The chart should have outlines of continents, islands, &c., marked in, for convenience, though in reality this is not essential, because the longitudes and latitudes of ports, &c., are alone really needed for determining the great circle course, and the course obtained by the simple constructions I shall indicate could always be plotted in on the Mercator's chart, to whose use seamen are more accustomed than to that of any other kind of chart.

The properties of the stereographic projection, which enable us at once to project a great circle course, and to determine bearings, distances, &c., on a stereographic chart, are the following:

(a) Every circle on the sphere, great or small, is projected into a circle.

(b) All angles, bearings, &c., on the sphere are correctly presented in the projection (a property found also in Mercator's projection).

With these properties I combine the following properties of great circles on the sphere:

(1) Since every diameter of a great circle is a diameter of the sphere, each point on a great circle is antipodal to another point on the same circle; or, in other words, if a

great circle passes through any point, it passes also through the antipodes of that point.

(2) If a great circle touches a small circle on the sphere, it touches also the small circle antipodal to the former: for instance, if a great circle touches latitude-parallel 30° north, it touches also latitude-parallel 30° south. This needs no demonstration, being really a corollary of 1: for the point in which the great circle touches one small circle has for its antipode a corresponding point on the antipodal small circle, and also, by 1, on the great circle: and there can be no other point in which the great circle meets the antipodal small circle: for if there were, then, by 1, there would be corresponding points of contact or of intersection with the original small circle, which by our hypothesis is not the case.

To use the charts, however, the seaman need not concern himself either with the method of constructing them or with the principles on which their use in great circle sailing depends. All he need care for is rightly to apply the constructions which result from these principles.

I propose to indicate only what are the processes necessary for the five following problems:

I. To find the great circle course between any two points, as A and B, Fig. 3.

II. To find the vertex, V, or highest latitude reached, on that course.

III. To find the bearing at any point, as Q, on the course.

IV. To find the composite course, from port to port, touching any given limiting latitude.

V. To find the distance, A V B, to be traversed.

The constructions for these five problems are all included in the following simple statements (P, Fig. 3, is the pole,

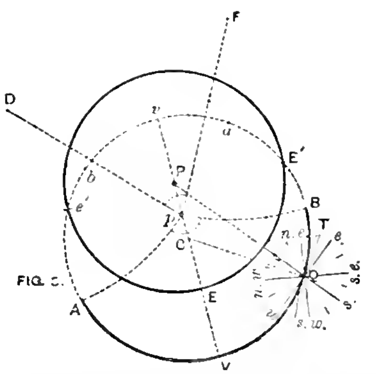


FIG. 3.

e′EE′ the equator), the italicised parts indicating the actual constructions, the rest giving the reasons and demonstrations:

I. *Find on the chart a and b the antipodes of A and B* (which of course is easy, as we have only to take off 180° on the meridians A P a, B P b, not shown in the figure to avoid crowding): then *a circle through any three of the points A, a, B, b, is a great circle of the sphere by 1, and must pass through the fourth point. Describe such a circle A B a b: A V B is the great circle course required.* [It will be best to take the three points A, B, and b, A being the point of departure. Pencil the bisecting-perpendiculars to bB, AB (not shown in Fig. 3), intersecting in C, around which point as a centre describe in pencil the circle ABb. Note whether it passes through a, for this serves as a test of the accuracy of the result. You may also note whether the points e′ and E′, in which it cuts the equator, are, as they should be, on the extremities of a diameter through P; for two great circles on a sphere necessarily intersect on a diameter of the sphere, and therefore, as P is the projection of the pole of the equator, two such points of intersection must lie on a straight line through P.]

II. *A straight line vPCV, through P and C, cuts the great circle course in V, the vertex required.* V being the highest latitude on one side of the equator, v that on the other. [V does not necessarily fall on the actual great circle course between two points. For instance, QB is the great circle course from Q to B, but V lies outside QB.]

III. *Draw QT, tangent to the course, at Q. Then the angle PQT gives the bearing of the course at Q from the due northerly direction QP.* By observing that QT is at right angles to CQ, we can get the bearing without actually drawing QT. Thus in the case illustrated in the figure, the direction QT is north of due east by an angle equal to CQP, easily measured with a protractor.

IV. Suppose A V B, Fig. 4, the great circle course, to have its vertex V in inconveniently or dangerously high latitudes. *Let L on PV be the highest latitude which the ship must reach. Take l, antipodal to* L: then if we *bisect l L, in G,* and describe round P as centre the circle *c G c′*, it is obvious that any circle having its centre on *c G c′*, and radius equal to GL or G *l*, will touch both the latitude-parallels

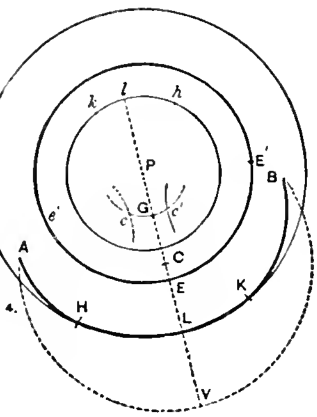


FIG. 4.

HLK and *klh*; and, by 2, will be a great circle. Therefore, *around A and B, as centres, with radius GL, describe circles cutting c G c′, in c and c′, and with c and c′ as centres and the same radius describe circular arcs,* AH, BK, *touching the latitude-parallel* HLK *in* H *and* K. *Then* AHKB *is the composite course required.* The distances along AH and BK can be determined by the method shown in the succeeding section, and the distance along the latitude-parallel HLK is of course easily determined, being an arc of a known number of degrees in a known latitude.

V. [We have to determine how many degrees there are in the arc AVB, not as it appears in the chart, but as it really is on the sphere.] *Take p, 90 degrees of latitude from V and v, Fig. 3, along vPV.* (This of course is done at once on the chart, which shows the degrees of latitude from the pole P.) Then *p* is the pole of AVB. *Find* D, *the centre of the great circle* A *p, and* F, *the centre of the great circle* B *p.* (This we do by I.; but most of the work is already done. We have the bisecting-perpendicular to B *b*; the bisecting-perpendicular to A *a* passes through C; then the bisecting-perpendiculars to A *p, p* B, give us—by their intersections with those to A *a* and B *b*—D and F at once.) What we want is to determine *the angle* A *p* B, between the arcs A *p, p* B: and it is obvious that this *is the supplement of the angle* D *p* F, which is easily measured with a protractor. *The number of degrees, multiplied by 60, gives the number of geographical miles, or knots, in the distance* AVB.

An example of these methods is given in the accompanying stereographic chart, where the same letters are used as in Figs. 3 and 4.

[By a singular coincidence the distance actually determined by my construction for the great circle course from Cape Town to Melbourne was 5,567 miles, the nearest result in whole numbers to the distance determined by calculation, viz., $5{,}566\frac{5}{6}$ miles. But having obtained the angle 92° 47′, I did not consider anything closer than $92\frac{3}{4}°$ could fairly be used, giving the distance 5,565 miles (very close for a determination of this sort).

The distance between Cape Town and Melbourne on a rhumb course is 6,154 miles, *or* 587 *miles longer than the great circle course!*]

The illustrative chart shows, on a small scale, my northern chart on the plan described. It has been carefully drawn, with meridians and parallels ten degrees apart correctly placed. The distortion is great outside the equator, but not greater than for high latitudes in Mercator's chart; nor does distortion at all affect the utility of such charts. (The stereographic and Mercator's projections are alike in showing small regions with little distortion.) More than thirty great circle-paths are shown, but of course the charts which I have had prepared for sailors' use (under Mr. E. Stanford's supervision) are without paths of this sort, the object of the charts being to enable the seaman to lay down without trouble the track he has to pursue in order to traverse the shortest distance from any port whatever, *or from any point he may have reached on his journey*, to any haven.

The north pole being in this chart the centre of projection, the northern regions are on a relatively small scale. Thus, the few great circle tracks shown on the Atlantic are not so well presented as the tracks in the southern seas, or from the northern to the southern hemisphere. The meridians and parallels of the chart serve, however, equally well for a map of which the south pole would be the centre. I have had a second chart prepared on this plan (the distortion affects Asia and North America very curiously), and the smaller map (a quarter of the chart) shows the North Atlantic as presented in this chart, the projection and scale being the same as for the larger chart. Although my large northern chart would suffice without any supplementary southern chart, yet the southern scale adds greatly to the completeness of the work. Moreover, by applying rule I. for pencilling the course on both charts, and comparing the results (which ought to agree, of course, exactly) the seaman will escape all possibility of any error, however slight, and will find his confidence in the accuracy of the method strengthened, should he, by chance, be unable to understand the mathematical reasoning on which the method is based.

THE VOYAGES OF COLUMBUS CHARTED.

By Richard A. Proctor.

To illustrate at once the convenience of the one-scale maps now appearing monthly in Knowledge, and the advantage of great-circle routes across the ocean, I give a map (No. 1) on the same projection in which the routes followed by Columbus across the Atlantic have been laid down for comparison with the corresponding great circle routes. The map also shows the shortest routes between several places in Europe and America, together with the rhumb course between Queenstown and New York (the course indicated as the shortest in Mercator's charts, but really not so).

On Friday, August 3, 1492, Columbus, in command of a squadron consisting of the *Santa Maria* (a decked vessel) and his flag ship, the *Pinta*, and the *Nina*, set sail from Huelva on his first journey across the Atlantic in search of a westerly route to "far Cathay." In the same year a globe was made at Nuremberg, from which the accompanying map (No. II.) has been formed. By comparing it with map I., which is in fact a chart of the North Atlantic, some notion can be formed of the ideas which were entertained by the most experienced geographers in the days of Columbus about the unknown Western Seas. About as far west from Europe as the shores of the United States really lie, we find Cathay, a small island, and Cipangu, a larger one, doing duty, but most inefficiently, and far from their proper latitudes, for China and Japan. What island it may be, to which Sieur Brandan came in the year 565, it would be difficult to determine; but neither Behem nor anyone else in those days had clear notions about the distances traversed by voyagers who reported shores they had sighted. However, this island was reported to have been seen by travellers sailing south-west from the Cape Verde Islands, and is therefore probably altogether mythical.

On August 9 Columbus sighted the Canaries. It was not, however, till September 6 that the squadron sailed from Gomera, nor till Sunday, September 9, that the heights of Ferro, the most westward of the Canaries, faded from view. On September 13, about six hundred miles due west of Ferro, Columbus noticed the variation of the needle, five or six degrees eastwards of true north,* a deviation which increased as he proceeded.

On September 14 the voyagers saw a heron and a tropical bird which they regarded as harbingers of land; but, on the following night, they were alarmed by a meteor, which they held to be ominous. Columbus explained the meteor after the simple manner of his time, when science understood everything; Irving, however, condescendingly remarks that these objects are common in warm climates, a statement about as instructive as though he had said that planets are peculiar to the subtropical skies. On September 20 the wind, hitherto from the east, veered to the south-west, and they altered their course (when in about 40° west longitude) slightly northwards. Several birds, regarded as denizens of the land, visited the ships, and next day the squadron reached the Sargasso, or great seaweed bed, which they endeavoured to avoid. On the 25th the wind again became favourable, and for several days thereafter they sailed steadily southwestwards, taking an almost due westerly course on September 30. On October 6 Martin Pinzon, commander of the *Pinta*, proposed that they should stand more to the southward, and in the evening of October 7 Columbus altered the course very slightly southwards, being then in about west longitude 65° from Greenwich. For three days they stood in this direction, the signs of land becoming more and more frequent. The crews, however, regarded these signs as meant to lure them to destruction; and Columbus, who had hitherto kept his men in good spirits by gentle words and promises of reward, was compelled for the first time to adopt a sterner demeanour. This was on Wednesday, October 10. On the 11th the signs of land became unmistakable. It was at about ten, on the night of Thursday, October 11, that Columbus saw a light glimmering at a great distance, which he showed to Pedro Guiterrez, "gentleman of the king's bedchamber," whatever dignity

* Washington Irving says the needle pointed to the north-west, but that is wrong: what Columbus found was that the true north lay to the west of the point indicated as north by the magnetic needle; probably Irving was misled by the circumstance that now the needle points west of north at the place where Columbus first discovered its deviation. The magnetic pole was considerably east of the latitude of Greenwich in the year 1492.

that may imply. At two on the morning of Friday, October 12, a gun from the *Pinta* announced that land had actually been sighted; and in the morning a level island was seen, several leagues in extent, and covered with trees like one great orchard. The inhabitants could be seen issuing from all parts of the woods, and running down to the shore.

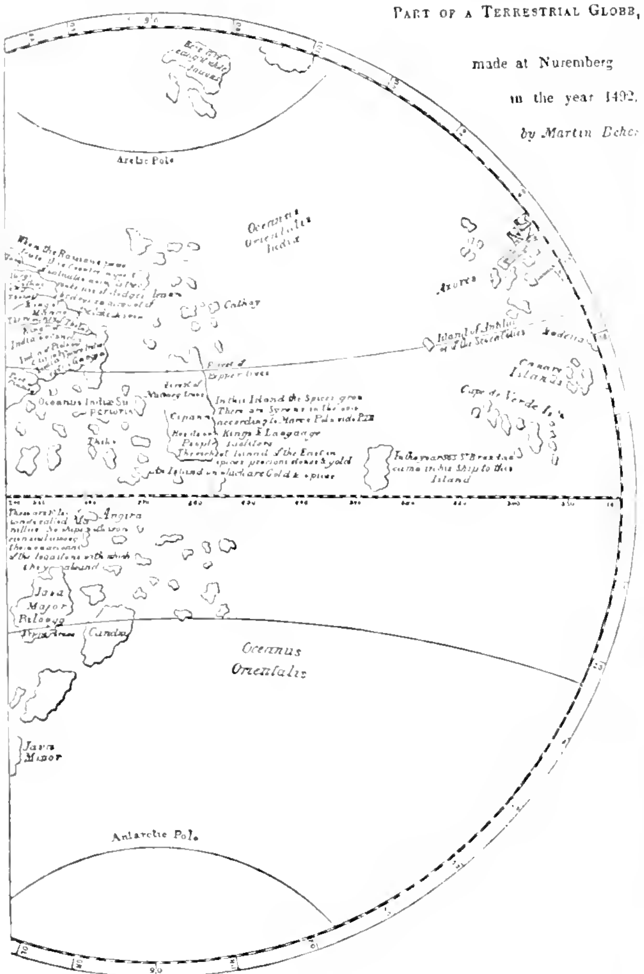
This island, still called San Salvador, as named by Columbus, is also called Cat Island, after the less euphonious and dignified name which the English masters of the Bahamas have thought appropriate. The light seen by Columbus was probably on Watling Island, which lies a few miles to the east.

After voyaging about among the Bahamas, and discovering St. Domingo, Columbus sailed for home on January 16, 1493. But it was not in the *Santa Maria* that he made the return journey. She had been lost through the negligence of a boy left in charge of her, and Columbus transferred his flag to the *Nina*, in which, after narrowly escaping destruction during a great storm, he finally reached the harbour of Palos, on March 15, 1493, having been absent seven and a half months.

Map I.

The map shows how much his journey to San Salvador might have been shortened had he known how the land lay. For in maps on this projection the great-circle or shortest courses from place to place are represented very nearly by straight lines, as the meridians show (which are all great circles); and it is only necessary to compare the actual length of the track followed by Columbus from Huelva to San Salvador with the shortest route shown—running across the easternmost of the Azores—to see how far Columbus went out of his way.

But apart from any trustworthy information as to the position of Cathay, Columbus might, with a little knowledge of the properties of the sphere, have recognised that his shortest course to the East Indies, as pictured in the maps of his day, required him to run as far northwards as the course marked in Map I. from Cape St. Vincent to St. Augustine, Florida. By following such a course he would have been brought, after rounding the Azores on the north, to more southerly latitudes, and finally into the latitudes of the



MAP II.

Canaries, somewhere in west longitude 85°—before reaching which, however, he would have fetched the shore of Florida.

The other outward journeys made by Columbus were not less circuitous. The student of Washington Irving's Life of Columbus will find it interesting to follow these journeys on such a projection as Map I., or, even better to mark it in, as shown from day to day on Mercator's charts, on the map of the Atlantic at page 106, where the currents of that ocean are also shown. In the second journey Columbus, after first discovering the North Caribbee Islands, passed within the Caribbean Sea, and discovered Jamaica and Cuba. On the third journey he would doubtless have discovered the mainland of South America, had not provisions run short, compelling him to take a more northerly course for the region where he knew land lay. He thus reached Trinidad, so named by him because of a great triple mountain on the island. The fourth journey took him to the South Caribbee Islands, and, again passing into the Caribbean Sea, he reached the mainland near Cape Honduras; but Ojeda had reached the mainland of South America (probably Surinam) in 1499, nearly three years earlier.

It will interest the reader to compare together the various tracks across the Atlantic shown in Map I., all of which, except the rhumb course from Queenstown to New York, are the shortest routes between the places they connect.

The map has been drawn specially, however, to illustrate a little work on America which I am now preparing. It will be observed that only the thirteen States which proclaimed their independence more than a century since, and being chiefly of British blood most manfully maintained their independence and established it, are shown on the westward side of the map. The area which our British colonies then occupied can be recognised at a glance, and compared with the area of Great Britain and Ireland on a map such as this, whereas no ordinary atlas conveys clear ideas on this point. We see also, what no map hitherto drawn has I think properly shown, not only the relative areas of the home country and its colonies, but, properly represented to scale, the distances separating the Britons at home from their kinsmen across the Atlantic. But for this convenient remoteness, our gallant fellow-countrymen on the other side of the Atlantic might haply have had to wait for a generation or two longer before they were able successfully to get rid of the blundering sway of the crazed German George III., supported by a large but silly section of the folk at home.

ORIGIN OF LANGUAGES.

AMONG the curiosities of the science of our day a chief place must be assigned to the evidence which has been obtained from the study of language in regard to the past history of various races. If we consider the crude attempt made by a Semitic race to interpret the variety of human methods of speech, and contrast that quaint story of the dispersion of man with the conclusions resulting from the careful study of the evidence given by languages themselves, we find something truly marvellous in the progress men have been able to make in dealing with the mystery of language. The story of Babel is like giving up the riddle; the results already obtained by philologists seem by comparison like a complete answer, though in reality they bring before us difficulties greater far than those they remove. In this, however, the study of language resembles all other study. All knowledge really worth anything increases our consciousness of ignorance.

It is from language alone we know that the Indians and the Persians are nearer of kin to us than the Jews or Syrians, for the beginnings of all four races are lost in a remote antiquity. But the connection between the Indian language (even in its ancient form as Sanskrit) and modern languages of the Teutonic family is not obvious until the rules for making comparison are recognised. For instance, one would hardly suppose that the relationship between the Sanskrit *vrkas* and our English "wolf" could be shown to be demonstrably real, or in fact more than the merest guess. Yet this relationship is only one of a set, and when we take the same word in various Indo-European languages, we find that the law of the connection shows itself even on the strength of this one word alone, though, of course, for complete demonstration other words associated in the same way have to be considered. Thus we have:—

Sanskrit	*vrkas*	Old Bulgarian	*vlukir.*
Greek	*lukos*	Gothic	*vulfs.*
Latin	*lupus*	Old High German	*wulf.*
Lithuanian	*vilkas*		

Even the connection between Greek and English is by no means obvious till the law of kindred is pointed out. The connection between *pater* and *father* is indeed easily recognised; but one does not at once see how *dĕka* and *ten* are connected, yet nothing is more certain than that these two words not only mean the same number, but mean it in the same way. To trace the connection we have to go back to the Gothic *taihun* or two hands, from which our "ten" is unquestionably derived. But even *taihun* differs slightly from *dĕka*. We notice further, however, the Latin *decem*, the relationship of which to the Greek *dĕka* is certain (though affected by our mode of mispronouncing the Latin "c"). Now, the Teutonic "h" was the equivalent of the Greek and Latin k or c, as *horn* for *cornu* shows, or the Gothic *hund* for *canis*, or *tiuha* for *duco* (or, conversely, *garden* for *hortus*=Greek *chortos*). So that we recognise in *decem* and *dĕka* words indicating two hands, as, indeed, the "ten" in any language is bound to do. The word "ten" is fully as much altered from the original *two-han* or *taihun*, as *decem* from *duo* and *ken*, or *hen*, which last root we recognise only in its compounds, *prehendo*, *comprehendo*, &c.—the old verb *hendo*, to grasp with the hand, having early disappeared from the Latin. Of course, in *canis* we have the idea of grasping just as we have in our English *hound*, the connection of which word with *hand* is undoubted. In passing we may note the connection between *prize* and *hand*, which seems at first sight incredible, but properly looked at is obvious, being simply shown by the series, *prize*, *prise* (Fr.), *prendre*, *prehendo*, *henden*, hand.

One might cite, again, the connection between the Greek *pente* and the English *five*. At first sight there seems no connection at all. Bnt between the old Greek *pempe* (as in Homer) and the Gothic *fimf* the connection is clear enongh; and no one can doubt that our *five* is derived from the early Teutonic *fimf*. In the Latin we have *quinque*, *q* replacing *p*, instead of *f*, as in the Gothic. But *qu* was simply a strongly gutturalised *w* sound, as in old Scottish.

One of the strangest traces of the old language from which all the Indo-European or Aryan languages were derived, is found in our auxiliary forms, *were*, *wert*, corresponding to the German *werden*; for, going back, we find in Anglo-Saxon *weorthan*, in Old High German *werdan*, in Gothic *vairthan*—that is, we find the root forms *weorth*, *werd*, *vairth* — while in Latin we have *vertere* (root *vert*) and in Sanskrit *vrt* (the exact vowel sound before the *r* unknown).

All this has been brought to my thoughts by the idea of a new universal language—a sort of correction of the Babel mistake, so far as the language of commerce, at least, is concerned. This new language has cost its inventor, M. Schleyer, of Constance, no less than twenty years' labour; but it can be learned in eight lessons (he says). Supposing all nations accept it, and all men engaged in business take their eight lessons, this pleasing language will occupy the same sort of position the world over which "pigeon English" now occupies in China. Its vocabulary is a miscellaneous gathering from many languages, English claiming a goodly share. All its words are monosyllables. Time is *tim* in Volapuk, as the new language is cheerfully called; stone is *ston*, and smoke is *smok*. So far all is easy, we seem to have been speaking Volapuk all the time, without knowing it. But alas, wisdom is *sap* (*verbum sap*); pain is *dol*, and a river is *flum*, all which words are objectionable to English ears. Then the monosyllables are put together into words suggestive of worse than Babel. Thus we are told to believe that *Liko stadols* is a suitable way of saying, "How are you?" and *Glidi sol* a proper expression for "Good day, sir."

Judging from the history of former attempts in the same direction, Volapuk is not likely to come very soon into general use.

It is interesting to observe how language illustrates the past development of races. We may find no material records of the spread of a race over the earth's surface, and yet be as certain from the evidence of language that the race has occupied such and such regions as if we found the remains of buildings they had erected, or of works of various kinds which they had executed. We can in this way find also in language some evidence as to the part of the earth from which the Indo-European races originally spread. It would seem that the Aryan Indians of Lower India came from the Punjaub, and earlier still our Indo-European ancestors appear to have occupied the Highlands of Central Asia to the west of Belurtag and Mustag.

THE GREAT LICK TELESCOPE.*

By Richard A. Proctor.

THE time draws near when science will learn how much the great Lick Telescope, perched on its exceeding high "mountain," may be expected to reveal. The expectations of the world outside science are also "exceeding high," especially in America, and still more especially in the far West. Yet we have had some disappointing experiences during the past ten or twelve years, which shonld lead us to limit our expectations in regard to the achievements of very large telescopes. Those recently made seem to have hitherto proved too much for the observers employed to use them; at any rate, observers very active in discovery when employing smaller telescopes, have done little when set to work with these larger ones, so that grave fears have been aroused lest science may have been the loser, instead of being, as had been hoped, very greatly the gainer, through the construction and erection of these powerful telescopes.

There can be no doubt that theoretically a large telescope is capable of doing better work than a small one. Not only are the space-penetrating and illuminating powers of large telescopes greater, but their defining powers are also better, even when their magnifying powers are not pushed to their full range. A close double star, for example, which an 8-inch telescope shows as two disks touching or overlapping each other, will appear with the same power applied to an 18-inch telescope as two well-defined disks, clearly separated from each other. Increase the power in each telescope, and whereas in the former no separation is effected, with the larger the dark space between the disks is correspondingly widened. Let the smaller telescope even be the most perfect work of Alvan Clarke and his skilfully co-operative sons, while the larger is perhaps the work of only a second-rate optician, yet will the larger attest its superiority in the same decisive way. All the skill even of the Clarkes would not enable an 8 inch telescope to separate double stars lying within a certain degree of proximity which a 15-inch or 18-inch telescope would resolve quite easily. And manifestly, when we consider that every object examined with a telescope consists of multitudes of points whose aggregate

* From the *New York World*.

forms the image of the object, we see that the defining powers as indicated in the study of close double stars, must determine also the comparative powers of telescopes in showing the details of the surfaces of sun, moon, planets, comets, and star-clouds.

There can be no doubt whatever of the potential value of very large telescopes. If we could estimate the value of a telescope simply, without regarding the man at the small end of it (stay: with reflecting telescope we find him sometimes at the large end), we could have no doubt as to the desirability of setting our Clarkes and Grubbs and the rest of them making the largest telescopes money can buy. But if we are to judge by the experience of the last twelve or fifteen years, we must infer that very large telescopes may fail in actual service, even as the great two-handed swords of the Swiss failed in the hands of warriors effectively skilful in the use of less unwieldy weapons. (*Teste* Arthur Phillipson in "Anne of Geierstein.")

The first example which occurs to me is that of an esteemed friend of mine in England. Nothing could have been more admirable than the way in which he worked alike with telescope and spectroscope, and with both combined, when he possessed only an eight-inch telescope. Every one expected that when a convertible fifteen and eighteen-inch telescope was placed at his disposal by the Royal Society he would effect correspondingly enhanced achievements in the way of discovery and research. But all the work done by him with the large telescope during the last twelve years is much more than outweighed by his work in 1864 alone with the small one.

In America examples are more numerous simply because a much greater number of large telescopes has been erected here. (Newall's and Buckingham's large telescopes in England were such utter failures that one is moved by pity not to touch on their achievements—at least, one would be if there were any achievements to touch on.) There was the great telescope at Chicago, an 18-inch of Alvan Clarke's best workmanship. Beyond enabling Burnham to test the value of the double-star observations he had made with a much smaller instrument, this splendid telescope has done nothing. A treatise on astronomy which mentioned nothing discovered with the great Chicago telescope, or with the equally large telescope set up at Charlottesville, near Richmond, would be certainly none the worse for the omission.

One cannot say this of the great telescope at Washington, because no treatise on astronomy would be complete which did not mention the two moons—if moons they should be called—of the planet once called by Tennyson the "moonless Mars." Undoubtedly the discovery of these two bodies was an interesting achievement. Their very minuteness, though detracting from their importance, adds to their interest, and also of course made their discovery more difficult. They may not be moons in the sense in which such orbs as our own moon and the moons of Jupiter are so called; for the two together would probably make but about one-millionth part of our own moon's volume. But they have enabled astronomers to correct their measure of Mars's mass, and they have suggested most instructive thoughts as to the probable processes by which the Martian system was formed. The great telescope at Washington will always be honourably remembered and Professor Hall always gratefully mentioned in connection with the discovery of these tiny bodies. Yet, regarded as a telescopic achievement, this sole work of the great 26-inch telescope (except two or three fairly good drawings of Saturn by Trouvelot, some mediocre pictures of Jupiter and an "atrocity" by Mr. E. S. Holden, claiming to represent the great nebula in Orion) can hardly be esteemed impressive. It would have been very discreditable if the moons of Mars had escaped discovery by an instrument which, it now appears, has ten times the light-gathering power necessary to show them even under much less favourable conditions than existed in August 1877, when they were discovered. True, many very powerful telescopes which ought to have discovered the Martian moons, had been turned on Mars without showing them. Had the Washington telescope failed, as used by Professor Hall, the discredit of the failure would have had to be so widely shared that it would not have amounted to much. True, also, that there is nothing new in the recognition of different objects with small telescopes after they have been discovered by large ones, and when the observer knows just where to look for them. (My friend Mr. Ward, of Belfast, can actually see two of the moons of Uranus with a 4-inch telescope.) But neither circumstance can take away from the fact that both the moons of Mars were easily within range of the great telescope at Washington when discovered, and that they could only be missed through such carelessness of survey as unfortunately had been usual in all former search for Martian satellites.

Probably Professor Hall would be the last to compare his discovery of these two bodies with William Herschel's discovery of two moons of Uranus, remembering how in his own case a splendid telescope had been constructed for the work by the ablest opticians living, whereas Herschel made his own telescope, while also—a circumstance not dwelt on quite so much, I think, as it should have been—Herschel had not only made the telescope with which he discovered the moons of a remote planet, but had begun the work by first discovering the planet itself on which those moons attend.

I do not care to dwell on the most striking example (in America) of the disappointment apt to result from the construction of a very large telescope for use by an astronomer who has achieved important success with a small one. It has been my special pleasure to dwell on the successes of American astronomers. These even now do not receive nearly the amount of attention in the old country that they merit, and are often treated most unfairly, as in the case of the admirable work of the astronomer whose loss science still feels—my valued friend, the late Dr. Henry Draper. American astronomical researches were scarcely noticed at all in England till I directed special attention to them, insomuch that an eminent English man of science, somewhat exaggerating, once spoke of me as having "discovered American astronomy" for my fellow-countrymen. It would therefore not be agreeable to me to dwell on disappointments in a case where my own expectations and the hopes of American men of science had been highest. But it is certain that what I have said of our ablest telespectroscopist in England may be matched—and I fear more than matched—by what might be said of the ablest telespectroscopist in America. With a telescope of tenfold greater power he has achieved less in the last ten years * than in any one of the ten years or so preceding them.

When I am asked, then, what science may hope or expect from the great telescope of the Lick Observatory, I feel constrained to reply that, judging from recent experiences, we can hardly expect aught but disappointment, though we may hope ("hope springs eternal in the human breast") for better things. Let science comfort herself with the thought that at least no Young or Huggins will be expended vainly, judging from present appearances, in the attempt to make the big telescope a great success. This at any rate is something, though it would count for more if some despotic

* The telescope has only been actually at work about six years, it seems.

friend of science could take away from these most able observers their big playthings and send them back to the smaller instruments with which they did such noble work.

THE JAPANESE MAGIC MIRROR.

By J. PARNELL, F.R.A.S.

I THINK I can give Dr. Hutchinson the information he requires, as I investigated the matter more than twenty years ago, and had the good fortune to arrive at a satisfactory result. If Dr. Hutchinson will examine his mirror carefully he will, I think, find that it is not absolutely plane, but more or less convex, and the phenomenon in question is due to the fact that the portion of the surface behind which is a raised figure is, if not plane, at least flatter than the rest of the mirror. Consequently when a parallel beam of light, such as comes from the sun, is reflected by the mirror on to a screen the general convex surface will disperse the light more than the plane portions, which in consequence will appear on the screen as bright figures. I arrived at this result by a careful examination of the distortions produced in the image of a luminous globe as viewed in the mirror, and the result was published in 1866 in *The Reader* (since extinct); and afterwards, in July 1877, finding that the explanation above given was not generally known, I republished in *Nature* the substance of the previous communication. Subsequently, and I presume independently, in December 1878, Messrs. Ayrton and Perry arrived at the same result, and read a paper thereon at the Royal Society.

CRICKET AND BASE-BALL.*

By RICHARD A. PROCTOR.

FEW base-ball players know much about cricket; few cricketers know much about base-ball. I am not one of those who know much about both games: yet I know more about base-ball than most cricketers do. I have watched many games at it, and three of my sons have played at it during two or three years, in such sort as to be able to explain the points of the games I have watched and to tell me of a number of details which otherwise I should have known nothing about. In regard to cricket I have always been an enthusiast, and until this year, when the last available spot at St. Joseph was built over, I have played at the game whenever I had the chance. On the whole, it seems to me I am rather better qualified than most persons to talk about the two games, especially about those points of comparison on which I am about chiefly to touch, which depend on scientific principles of which few professional cricketers or base-ball players would be apt to know much. It happens, rather oddly, that during the past September 1886 an article of mine has appeared in the London *Times* on these special points of comparison, an article entitled "The Break at Cricket and the Curve at Base-ball," and I suppose that it was within less than a week of the appearance of this article in London that Key and Buckland, the English cricketers (one a leading batsman, the other a clever bowler), watched a base-ball game at Philadelphia, and subsequently tested the baffling effects of Fothergill's pitching.

That was not, however, by any means the first time that English cricketers had appeared on the base-ball field. A quarter of a century ago, when Parr and Caffyn brought over a first-class English eleven to America, long before the Australians had acquired the skill which recently enabled them to face on fully equal terms the best players in England (for it was Caffyn who, visiting Australia later, stayed there and taught young England to beat his mother). After the Englishmen had won their last cricket victory, they took part in a base-ball game in which, though they did fairly well, they found the Americans far their superiors. I question, however, whether the pitching of a quarter of a century ago would bear comparison with that which is now regarded as essential in first-class base-ball.

At any rate the English cricketers said nothing when they reached home about the various curves, which perplexed Key and Buckland at Philadelphia; and I cannot but think that if they had recognised these curves they would not only have spoken about them, but would have tried to bring them into effective action in bowling at cricket, as Buckland, I understand, thinks of doing.

Cricket then, as now, needed some new devices in the bowling department, seeing that already the bat was beginning to get the better of the ball. Formerly an innings of over 100 runs was thought excellent; but anything under 200 runs in first-class matches is now regarded as unsatisfactory; and we hear from time to time in matches not far from first-class, of a single member of an eleven at cricket making more than 400 runs off his own bat. (Such numbers as these serve of themselves to suggest to those who know only of base-ball and nothing about cricket, that the two games must be entirely different in character, as indeed they are.)

A few remarks on the essential features of cricket will not be out of place, then, in such an article as this, appearing in St. Louis, where I am given to understand they do not need any particular information about the game of base-ball—though I shall presently have a point or two to notice about base-ball which may be new to some even in the home of the champions of the world.

Cricket is essentially a game of attack and defence. A wicket formed of three upright stumps, with two cross-bars or "bails" at the top, is bowled at by a member of one eleven, while a member of the opposite eleven defends it with a bat. In the game as usually played now, though formerly single-wicket games were common enough, there are two wickets set twenty-two yards apart, each defended by a batsman; and after a series of four balls, called an "over," have been aimed by a bowler at one wicket, another bowler proceeds to trundle four balls at the other wicket. (It is hardly necessary to say that only one ball is used throughout, but the act of bowling is called delivering "a ball.") The bowler, then, attacks while the batsman defends the wicket. If the bowler can hit the wicket, or even touch it so lightly as to bring down one of the bails—the merest graze will generally do this—the batsman is out, and must be replaced by another. If, however, the batsman can strike away the ball in such sort that he and the other bat can exchange wickets before the ball is sent in again, that counts as a run. As many times as they can exchange wickets, each running across from wicket to wicket, so many runs do they count. They may run in this way even though the batsman has not touched the ball, if it is missed by both the wicket-keeper (corresponding in some degree to the catcher at base-ball) and by his backer-up, called the long-stop. Nay, a run is often stolen when the long-stop has not missed the ball, if he is slow in sending it in, and

* From the St. Louis *Globe Democrat* (October 31, 1886). The article is given in full, so that English readers may note whether my description of cricket, for comparison with base-ball, is correct or not.

the batsman can get across the twenty-two yards in time. Such runs are called byes. But all runs are made at the batsmen's proper peril. If a wicket is put down while the batsman nearest to that wicket is outside his ground (a small space close to the wicket) the batsman is out. So a batsman is out if the ball is caught from his stroke before touching the ground, or if in trying to defend his wicket he strikes it with the bat, even though he may but shake off a bail.

There is yet another way in which a batsman may be put out, and some of the prettiest play at cricket arises in connection with it. The process is called stumping out. In playing at a ball the batsman may get outside his ground; should the wicket-keeper in such a case receive the ball and with it knock off a bail before the batsman can put his foot or ground his bat inside the line which marks his ground, the batsman is out. A good wicket-keeper is as valuable at cricket as a good catcher at base-ball. The feats occasionally accomplished behind the wicket are little short of marvellous. To give an evidence of the neatness with which stumping is sometimes effected, take the following case: (it must be understood that nothing but the sharpest action will do the trick at all, because the moment the batsman finds the ball has passed him he puts his bat down within his ground like a shot). On one occasion, Box, a famous wicket-keeper of the generation before last, took a ball which had passed the bat, hit up a bail with it, caught the bail in the other hand, replaced it, and left it, all so sharply that the first intimation the batsman had of his fate was that conveyed by the umpire's reply, "Out," to the customary query from Box, "How's that, umpire?" All had been accomplished in the mere instant of time following the batsman's failure to hit the ball, and not only before he had time to put his bat down within his ground, but before he could even look round.

What I have said is about all that is necessary to enable one who has never seen a game at cricket to understand the nature of the game. The bowlers attack the two wickets alternately; the batsmen defend and endeavour to make as many runs as they can; the wicket-keeper and long-stops stand behind the attacked wicket, and the remaining players on the attacking side are placed at various points to catch the ball if possible,* or to intercept it, or (failing either) to go after it, and return it *quam celerrime*. As batsman after batsman succumbs, the place of the fallen is taken by another, till at last ten of the eleven have been put out, when, since it takes two players to defend the pair of wickets, the eleven are all out, and their opponents in turn take their innings. Two innings, neither more nor less, on both sides constitute a game, though, of course, both innings on one side may be beaten by a single innings on the other, in which case only three are played.

And here I take it is the weak point of cricket. A great match is always arranged for three days' play: but on the one hand three days may not suffice for the game to be played out, in which case it ends in a draw, even though one side has manifestly the worst of it, or, on the other hand, the game may be finished in two days, or even in one, in which case the balance of the time assigned to the match is lost. To give an idea of the annoyance often occasioned in one or other of these ways, I note that of forty games played by the Australian eleven in England last season, seventeen only were played to a finish (several of these lasting only two days), no less than twenty-three being drawn. (Of the seventeen games, the Australians won nine and lost eight, but as the two leading English counties lost only three games and five games, respectively, of those they played during the season, it will be understood that the Australians were by no means so successful last season as they have been aforetime.) I long since proposed a very simple and effective remedy for this serious fault, from which base-ball is altogether free. I suggested that instead of playing out a whole side at each innings, the sides should go in alternately as man fell after man alternately on either side. In this way the contest could be continued throughout the whole time appointed for the match, with the certainty that neither would any game end in a draw (except in the natural way of equal play) nor would any time be cut to waste in any match.

Cricket being thus different in its very essence from base-ball, which is not a game of defence, all the details are naturally different in character. The very shape of the bats used in the two games indicates the difference between them. The cricket-bat is essentially a guarding bat; the base-ball bat, though most ludicrously pictured in Harper's edition of Charles Read's "Hard Cash" in the hands of a cricketer, and held nearly as a cricketer holds his bat when waiting for the attack, is altogether unsuited for defence. In like manner the cricket-bat would be utterly unsuited for such strokes as the base-ball player requires to make. One of the funniest things to a cricketer's eye is to see a base-ball player striking with a cricket-bat; but, I imagine, it must be at least as funny to a base-ball player to see a cricketer, even one of the most expert, handling a base-ball club. *Usum non habeo*, both one and the other might say with David in the Vulgate (imagine Latin as the vulgar tongue); but either might say more. The kind of stroke given in base-ball would be the worst possible form at cricket; so much I know, and I can guess pretty well what a base-ball player would think of the attitude in which a cricketer is expected to await the attack. "Play with an upright bat," says our rule, and "keep the left shoulder well forward"—how would that look at base-ball?

I am often asked (generally by cricketers) in which of the two games, cricket and base-ball, there is the most science. Nothing, I apprehend, but practical and long-continued experience in both games would enable any one to reply to that question; and very few have had that double experience. The cricketer who knows of the different forms of stroke by which the various devices of the bowler can be defeated and the fielders eluded, who recognises the beauty of the "cut" and the "draw," the attractiveness of the "forward drive" to "on" or to "off," and of the swiping "stroke to leg," the neatness of the "snick through the slips," the quaintness of the "stroke under the leg" (now seldom seen, by the way), when, looking on at a game of base-ball, he sees forward strokes within a limited angle to right and left, alone effective for base making, naturally imagines that there is much less science in base-ball hitting. The base-ball player, on the other hand, noting what seems to him the cramped position of the batsman at cricket, the frequency of "blocking" (that is, merely stopping the ball, or putting it away for safety), especially when the finest players are at work, is equally apt to conclude that cricket is a very inferior game. I remember watching the last three-quarters of an hour of the second day's play between

* There was a song about cricket, in which I often took part, in the good old days of Hullah, wherein we all chorused lustily (Hullahing, so to speak)—

The-en run, boys, run!
Sta-art ev'ry one,
To-o catch the ball
Befo-o-ore it fall!
He's out. The game is e-e-e-ended,
And we the game have wo-o-o-o-on,
And we the game have won.

But the captain of a team of fielders does not, as a general rule, insist on *every* one running to catch the ball; even two would be one too many.

the Australian eleven and Nottingham, our crack cricketing county, in 1884, when the most perfect display of all-round cricketing science was afforded that has perhaps been ever witnessed; and during the whole of that time not only were no big bits made—very likely that would happen in a base-ball match—but no player was got out, no progress made on either side. Every ball was sent down so dead on the wicket, so craftily pitched, so deftly twisted, that the batsmen dared take no liberties; every stroke was so skilfully directed, so nicely timed, so well adjusted, that the fielders got no chances. It was the perfection of cricket, but—it was a trifle monotonous.

If it is difficult to compare the batting science in the two games, it is almost impossible to weigh the relative merits of bowling at cricket and pitching at base-ball. Here, indeed, neither side can doubt the scientific nature of the art. The cricketer, though he never bowls curves, can see that the curve is a beautiful feature of base-ball pitching; and the pitcher, though he never sends a ball which touches ground between himself and the batsman, recognises that in a game where this is not only allowed, but essential, there is room for as much science as in billiards, where all the peculiarities in the motion of the ball arise from contact with the cloth.

The three games may, indeed, in this respect be ranged in order, though the science of all three be nearly equal. The base-ball does not touch ground at all, and none of the complexities of movement resulting from contact with a solid surface affect its motion; but the curving derived from contact with air is a most delicate and difficult scientific problem. The cricket-ball touches the turf once only (in good bowling) on its way to the batsman; but a delicate problem in dynamics is involved in the consideration of the effect arising from the momentary contact of a twisting ball with the ground. And lastly, in billiards, the ball touches the cloth all the time, with effects arising from the constant variation of velocity alike of advanced rotation, which suggest the most delicate and difficult dynamical problems. Possibly cricket, in its intermediate position, supplies the finest opportunities of all three games; for the bowler might cause the ball to curve in the air as well as to twist from the ground; and this, indeed, is what Buckland, the English amateur bowler, is said to intend to try next season. But as yet certainly nothing has been done in this way. It will be a matter of curious interest to note whether anything comes from the lessons in curving given to an English bowler of great skill at Philadelphia last month, by a crack American pitcher. (I trust, by the way, this word "crack" is in use in America, as with us, to mean first-rate. I beg the compositor not to set it crank.)

The curving in base-ball is a more difficult problem to deal with scientifically than twisting at cricket. It is much less easy to make experiments in curving. The effect of twisting is very easily tested, even in the length of a room; but for the curve such sharp propulsion (as well as rotation) is required that experiments can only be made in the field. The problem is one of the prettiest hydrodynamical problems known. (I am quite aware that the word hydrodynamical must here seem entirely out of place; but in our treatises on hydrodynamics, fluids as well as liquids are considered, and the student who wishes to deal with the curving problem scientifically must turn to treatises on hydrodynamics for the necessary formulas.) Every ball flung through the air is in greater or less degree deflected from the course it would have in a vacuum, whether it spins or not. The parabolic path of a projectile is a myth so far as projectiles in air are concerned; and an artillerist who, knowing the velocity of the ball at the cannon's mouth and knowing the angle at which the cannon is inclined, were to calculate the place where the ball would fall on the ordinary parabolic idea, would be out not only by a few yards, but by hundreds, in some cases by thousands. A base-ball is pitched sharply enough to deviate measurably from the parabola without any spin at all. It carries in front of it a little cone of compressed air, which is all the time opposing its advance with an action akin to that of a spring.

But this effect is one which the batsman would take into account as unconsciously, and therefore as uniformly, as a man does who catches a ball pitched to him from a long distance and really travelling yards from the parabolic path; for the slowing of the ball on account of atmospheric resistance takes place in a uniform way. When, however, the ball is pitched with a spin which carries one side of its advancing face forward and the other back, the cone of compressed air in front is no longer symmetrically adjusted. The compression is greater on the side carried forward by the spin, and less on the side carried backward; for on one side the air is not able to slip past the ball so readily as on the other, and naturally gets compressed on that side when its passage is impeded by the friction of the spinning ball.

Now, a cushion of air, though not so hard as the ground or as a billiard cushion, has resisting power all the same. The ball, resisted on that side, is deflected to the other. An odd thing in seeming, though the mathematical equations explain it, is that the deflection does not begin from the beginning or increase gradually, but nearly all of it seems to take place after the ball has passed a certain distance, varying according to the initial velocity. It is this, indeed, which makes the curve so effective in deluding the batsman. The twist at cricket, as at present chiefly used, has no tendency to cause the ball to curve in the air. One side or other of the ball is sharply brought down, so that the axis of rotation lies in the ball's track, and the ball begins, as it were, to roll the moment it touches ground, so that though the touch is instantaneous only, the ball is sensibly deflected.

Gossip.

By Richard A. Proctor.

The article on large telescopes quoted in this month's Knowledge from the *New York World* is well meant, as readers will notice, and I think most English students of science, at any rate, will admit that, while I have been generous, to say the least, towards American astronomers ever since I wrote about astronomy at all, nothing in that article is inconsistent with what I have elsewhere written. Yet, somehow, the publication of this article in the widely-circulating columns of the *World* has brought down upon me a small cyclone of mixed reproaches and misrepresentation.

* * *

First, Professor Young, who assuredly has had small reason to complain of anything I have said of his work in the past, complains bitterly now because I have suggested that the kind of work he is doing with the very fine telescope placed in his hands at Princeton College, N.J. (expressly, be it understood, that he should go ahead of his former self, as well as of his great English rival, Mr. Huggins), is of very little real value. True he has done work which he could have done with no smaller telescope—he has measured positions of Phobos and Deimos, those two faint satellites of Mars, and (I believe) of Hyperion, the seventh and most difficult satellite of Saturn, while a number of close double stars and very minute companions have had their distances and position-angles measured by him, or under his superintendence. But when the value of all this towards the advancement of astronomy is inquired into, neither he nor anyone else can give any satisfactory answer; while, for my own part, I say very confidently, "These things you should have done"—they *have* a sort of value—but "you should not have left the others undone." And when I am gravely told that, while as yet the spectroscopic analysis of solar phenomena was new, everything of real interest was done with the small telescopes which Young and Huggins then used, and that in *such* work their large telescopes could make no effective advances, I have no answer but a smile—which is not altogether one of amusement. Mr. Huggins, indeed, *has* done other and good work, though unfortunately led off on a false scent by the hope of photographing the corona.

* * *

NEXT, Professor Asaph Hall writes to me that a friend of his at Washington told him my article denounced him in "scathing" terms, so that he "was quite surprised to find on reading it that, on the whole, it was fair." Yet, none the less, he writes me a letter worded precisely as though, instead of speaking of him in terms of high compliment, I had indeed denounced him. And after entirely mis-reading the article—as if I wrote expecting the discovery of other bodies like the satellites of Jupiter and other planets like Uranus—he asks me why, if the discovery of the satellites of Mars with the large telescope at Washington were so easy, "your friend Holden, who made drawings"—and very bad ones they were—"of Mars all through the opposition of 1875, failed to discover them?"—which will be seen, on a reading of what I say, to be *nihil ad rem.*

* * *

LASTLY, though I might mention a number of other American astronomers who have kicked at my well-meant flicking—being indeed more sensitive than our stolid English workers could well conceive—does not "my friend Holden," as Professor Hall very naturally calls him (for when he introduced Hall and myself to each other at Washington he professed suspiciously warm friendship) renew the friendly ways of 1874 by carefully explaining at San Francisco just what my article itself states about the real superiority of large telescopes, and going on to say that only for a few "cranks" like the Wigginses and Vernors can there be any doubt on such points? In other words, with characteristic "candour," he conveys to his audience, as well as he knows how, that I am utterly ignorant of that which I have myself stated in the clearest terms.

* * *

THE "friendliness of 1874" to which I refer, consisted in the deliberate but anonymous statement in the *Atlantic Monthly*, that my first book, "Saturn and its System" (by which I lost what the profane would call "a pot of money," as Messrs. Longmans know) was so profitable, and "deservedly," he was good enough to say, that I was tempted to write a number of other books in order to make a large sum of money; and he went on to denounce among other books, by name, a book which he could not possibly have read, since it was at that time (though announced for completion earlier) lying half written only in my desk. Quite unaware of the authorship of this stupendously unveracious critique, I denounced the unknown writer in very plain terms in a letter which I sent to the chief American newspapers, several of which scathingly denounced his conduct in articles bearing such headings as "Dishonest Criticism," "Spiteful Reviewing," and so forth. The unknown critic replied, admitting his wrongdoing, but defending it in terms suggesting that he really was not aware of its iniquity. And then, still unaware of his identity, I simply declined to accept the apology, just as any good citizen would decline to accept the apology of a pickpocket, who, caught in the act of abstracting a purse, explained that he really had mistaken that purse for some one else's, and begged to apologise, &c., &c. The letter will be found in the *English Mechanic* for December (11th, I think), 1874.

* * *

ALAS! what was I to do, when I found, in 1876, who the offender really was? I know what I did. I remained silent, deadly ashamed and sorry for many a long year. But Professor Holden has brought the matter back to my recollection by virtually renewing his offence. Nay, he has deliberately repeated the untruth about my "Saturn," in company with several other new untruths, which it were weariness to specify.

* * *

HE pretends to believe that I am angry with him because he does not approve so much of my popular writing, which has brought me a maintenance, as he pretends to approve of my scientific writing, which might almost be said to have cost me one. His criticism could not hurt my feelings, since it applies to readers and buyers of my books rather than to me. If the public is interested by sound but simple exposition of scientific truths, and declines to be interested in such matter as I dealt with in "Saturn," the first edition of "The Moon," my "Geometry of the Cycloids," and the like, the fault is not mine, if fault there is at all. If I have made a decent and, I think, an honest livelihood by the explanation of scientific matters for unscientific folk, I have had this to justify me, that in no other way could I have continued my scientific *work*. I had the choice between professional but altogether unscientific work, official scientific work (wanting in independence—and perhaps requiring a little jobbery—and not leaving me free for original research), and just such work—explanation of matters scientific in lectures and books—as I have actually done, not wholly without success. By selecting the last course I have been able to carry on my original work, as I hope shortly to show in a treatise on General Astronomy, which will appear (in its first monthly part) next October. Most certainly I find nothing to be concerned at, when a man who has received large annual salaries at Washington and elsewhere for failing to do satisfactory work with magnificent opportunities, chooses to complain that my explanatory books have not been so unprofitable in the pecuniary sense as the more difficult treatises have invariably been.

* * *

WHAT has really concerned Professor Holden has been my being selected by the editor of the "American Cyclopædia" in 1874–75 to write the astronomy and meteorology for that book—work which he probably thought would have better suited him.

* * *

Map VI. of the "One-Scale Atlas" will appear in the August number, being crowded out by other maps this month.

Reviews.

Palæolithic Man in N.-W. Middlesex. By JOHN ALLEN BROWN. (Macmillan & Co.)—From the standpoint of prehistoric archæology there is very little, if anything, new to be added to our knowledge of man of the Drift period in Britain. Nevertheless, every item of corroborative evidence is welcome, and Mr. Allen Brown has done useful work in exploiting the gravels and brick-earths of the Ealing district in search of the stone implements which are the universal witnesses to man's presence and primitive low culture.

While the interest of his book is primarily local, it will be found serviceable as presenting in compendious form the materials of our knowledge of palæolithic man gathered since M. Boucher des Perthes' renowned discoveries in the Somme Valley. The lithographs of stone tools and weapons in use among existing savages enable the reader to deduce what was the condition of the races which have left like relics in N.-W. Europe.

The Ancient Cities of the New World.—By Désiré Charnay. Translated by J. Sonino and Helen S. Conant. (Chapman and Hall.)—The glamour which long hung around the ruined cities of Central America, their vast and highly-ornamented palaces and temples, their pyramids and statues, and the great dynasties of the Aztecs and Incas, all invested with a mythic antiquity, has faded away before the "dry light" thrown by sober exploration and common-sense interpretation. The Marquis de Nadaillac's "Prehistoric America" did good service in this direction, and although M. Charnay ventilates questionable theories of "origins" in this book, he admits their small importance. His explorations, the means for which were supplied by France and a wealthy American (Mr. Lorillard), range over thirty years, and form an extremely interesting though somewhat entangled record, through M. Charnay mixing up his adventures as a traveller with his work as an explorer. Following earlier theorists, he contends that the American civilisations, the relics of which are described and amply illustrated, are comparatively modern, and due to a pre-Aztec people, the Toltecs, who founded their empire in Mexico, and, after its disruption, transmitted their industries and mechanical arts to the people who succeeded them. Comparing the architectural remains and the evidences as to the modes of life with analogous materials scattered over the East, M. Charnay inclines to the theory of Toltec migration from Asia. But this convenient reference of all arts and civilisation to Oriental origin is somewhat played out: the generally uniform mode of development of races that have emerged from barbarism is fatal to precise theories of localisation of origin, and we may dismiss the question by advising the reader to study and form his own conclusions from the facts which M. Charnay has narrated in a style that appears to have lost nothing in its transfer from French to English.

The Western Avernus. By Morley Roberts. (Smith, Elder, & Co.)—We fear that this remarkably interesting book, with its intense humanness, pathos, brightness and beauty of style, is in danger of being overlooked in the crowd of ephemeral stuff that cumbers the reviewer's table and the circulating libraries' counters. The author puzzles us. Here is a refined and highly educated man, who with dyspepsia in his body, Emerson, Virgil, and Carlyle in his wallet, and apparently only enough money in his purse for the voyage, makes tracks from London to Texas, then to British Columbia, and finally to California, hiring himself out as bull-puncher, navvy, dock labourer, miller—in short, for any job to keep body and soul together; makes himself at home by his cheery tact and good humour, whatever his company; tramps weary miles in search of work, sleeps in railway trucks, and, after two years of roughing it, returns to England, to find, we earnestly hope, a large circle of appreciative and grateful readers of his adventurous and thoughtful narrative.

Arcady: For Better for Worse. By Augustus Jessopp, D.D. (Fisher Unwin.)—The earnest and sympathetic essays which compose these sketches of the life and general condition of the East Anglian peasantry well deserve rescue from the oblivion of the magazine in which they appeared. The Arcady which the learned author describes with shrewd insight, humour, and pathos, is no ideal state. The picture is charged with shadows; yet, on the whole, brighter than one might expect in these days of low prices, vacant farms, and general rush of the more able-bodied and intelligent villagers to the towns. The book raises and discusses temperately many economic problems, and to the treatment of every topic Dr. Jessopp brings a well-stored and sympathetic mind, which should secure his book serious attention from social reformers.

A Manual of our Mother Tongue. By H. Marmaduke Hewitt, M.A., LL.M., late Assistant Examiner in the University of London, &c., &c. (London: Joseph Hughes. 1887. Price 7s. 6d.)—This work, one of "Hughes's Matriculation Manuals," we cordially welcome. It seems to us to supply a want—a very different thing from being written to meet one, as so many school books profess to be. We know of no other book that we could so cordially recommend to students preparing for the London Examination. The subject as treated by the examiners has always been wide, and the syllabus vague; so that the numerous candidates have been compelled to read widely to cover the ground, with serious results to the depth of their knowledge. The work is evidently the product of a practised teacher. Where he has thought compilation better than original matter or treatment, large quotations are given and acknowledged. Alford, Abbott, Cobbett, Angus, Mason, Trench, and others are authorities behind whom there is no need to go, and their lucid exposition of principles is admirably made use of by the author in their appropriate place. The book is well arranged. Different type is used to accentuate important lists, divisions, sections, &c., &c., and at the end of the book are the examination-papers for the last ten years set at London University Matriculation. Blank pages are bound in for additional notes; and specially to be commended are a large number of Answered Questions upon various portions of the work. These may, and doubtless will, be taken as models by the student with advantage. We think the book will have a good sale.

Life of Darwin. By G. T. Bettany. (Walter Scott.)—There is nothing new in this brief sketch of the great naturalist's life and work. The man himself is not brought vividly before us, and the book reads more like a magazine article than a biography. But it has an especially valuable feature in the bibliography of Darwinism prepared by Mr. Anderson, of the British Museum. Mr. Bettany's proof-sheets have been looked over by Mr. Romanes, who therefore endorses the author's description of him as "Darwin's prominent disciple," and as "an undoubted authority in mental science."

Notes of a Naturalist in South America. By John Ball, F.R.S. (Kegan Paul, Trench, & Co.).—The modesty and thoroughness of this book are what might be expected from the cultured observer who gives us the record of his five months' tour round a continent where one sees the Southern Cross standing high in the firmament, while its scenery, north of Terra del Fuego, with its snow-covered peaks and huge glaciers, blended with foreground of dense forest and luxuriant vegetation, is described by Mr. Ball as unlike anything else in this world. Apart from much that is of special interest to the naturalist, the book adds to our knowledge of the social and political condition of the different countries visited, and has practical as well as scientific value for those whom Mr. Ball's pleasant experiences may induce to undertake the journey.

Through Masai Land. By Joseph Thomson, F.R.G.S. (Sampson Low & Co.)—Whilst all the world is reading Mr. Rider Haggard's African fictions, this new edition of Mr. Thomson's African facts, as to which no "strange case" can arise, is opportune. Young as Mr. Thomson happily still is, the rough apprenticeship which he had served in explorations of the great continent led to his selection as head of the Geographical Society's expedition to the land of the ferocious Masai, and well did he justify the choice. The story is one of unflagging interest and excitement, told with manly simplicity, and with touches of humour which once more belie Sydney Smith's charge of its absence in Scotchmen. How Mr. Thomson, at starting, could hire only a scratch crew, made up of the scum and riff-raff of Zanzibar, which he converted by his firmness and tact into loyal and decent men; how that same tact carried him along his perilous route, save when buffaloes gored and tossed him, and fever brought him to death's door; how he had to play the part of medicine-man, and with the aid of saliva, false teeth, Eno's fruit salt, and theodolite, work wonders in bringing rain, healing cattle, and other marvels of a character which we must leave our readers to learn for themselves, are all told in a book brimful of good things for the general reader, and of valuable notes on the manners, customs, and vague beliefs of the Masai for the anthropologist.

Social History of the Races of Mankind. Papuo- and Malayo-Melanesians. By A. FEATHERMAN. (Trübner & Co.)—This closely-packed volume is as difficult to review as an encyclopaedia. Dealing with the physical environment and character, the modes of life, dress or the absence of it, enjoyment, business, food, dwellings, government, language, birth, wedding and death customs, superstitions, legends (though too sparsely), and religions of two branches of the great Melanesian stock, embracing many grades of culture, from the savage Papuan to the more important and advanced people of Malay proper, it is essentially a working and, on the whole, an excellent *vade mecum* for the sociologist. In the enormous mass of detail, gathered and deftly woven together from numerous authorities duly scheduled at the end of each section, no microscope is needed to see that the author does not always seem awake to the significance of isolated facts; but we wonder that no reference should be made to the totem-signs and names of various members of the groups as indicative of belief in animal ancestry. Mr. Featherman is ill-advised in giving some reviewer of his former book occasion to blaspheme by the long preface which has only indirect relation to the subject-matter of the volume. We respect his independent exercise of judgment in treating of the intricate problem of geographical distribution, but his arguments in support of various originating centres ignore much that has come to light in further support of Mr. Wallace's theory since its first enunciation.

The Geology of England and Wales. By H. B. WOODWARD. (G. Philip & Son.)—This new edition of Mr. Woodward's work is wanted. The book has deservedly taken its place as the standard authority on English and Welsh geology, especially for practical application by engineers and others engaged in mechanical industries by virtue of its ample references to the principal localities where the several formations may be studied, and its consequent interpretation of the maps of the Geological Survey. It is copiously illustrated with figures of sections and accompanied by a good geological map in loose pocket.

The Blood Covenant: a Primitive Rite and its Bearings on Scripture. By H. CLAY TRUMBULL, D.D. (George Redway.)—This book is by an American divine who starts with the intention, which of course is fulfilled, to make the facts square with certain Christian dogmas. He has collected from various ancient and modern sources a number of interesting references to the widespread rite of intertransfusion or mutual tasting of blood as imparting a sacred and binding character to covenants between individuals or tribes, and it is not difficult to see how the early identification of blood with life would lead to its symbolical use in the relations of man with gods and with his fellow-man. But of course so simple an explanation suffices not for theologians, who regard all barbaric rites and ceremonies as distorted vestiges of a pure original revelation, and hence Dr. Trumbull sees in the blood-covenant an obscured antetype of the communion which Jesus has established with all believers in the drinking of his blood, symbolised by the wine of the Eucharist. Except for its facts, therefore, which are honestly cited, the book is valueless.

The Metal Turner's Handybook. By PAUL N. HASLUCK, A.I.M.E. (London: Crosby Lockwood & Co. 1887.)—The reputation gained by Mr. Hasluck by his now familiar book, "Lathe Work," is sustained in the smaller volume before us, in which within the compass of 140 pages he contrives to impart a very considerable amount of information on the subject of metal-turning. In his description of the various types of lathe and accessory apparatus, he appends in each case the price at which the things described are purchaseable; but as he ranges over the forms constructed by a considerable number of makers, this innovation can scarcely be said to assume the form of advertising. Certainly it will be found useful by the beginner possessing a definite knowledge of his own pecuniary means, but hazy and uncertain as to what is procurable with them. The illustrations are numerous and excellent, there is a good index, and, in short, the beginner in metal-turning will find this a trustworthy guide to a recreation at once serviceable and pleasant.

Notebook on Plane Geometrical Drawing. By ROBERT HARRIS. (London: Hamilton, Adams, & Co. 1886.)—This work may be confidently recommended to all who wish to master the technicalities of geometrical drawing; its author's obviously intimate personal acquaintance with his subject enabling him to simplify his explanatory text so as to render it easily apprehensible by the beginner. His chapter "Concerning Scales" is particularly good; while that on "Graphic Arithmetic and Statics" will open a wholly new world of investigation to a good many of his readers. But why will he say (p. 109) "The double accent (″) signifies inches"? It does *not* signify inches, any more than "£" or "cwt." signify inches. It signifies seconds of arc and nothing in the world else; and every one who has the purity and definite connotation of scientific terminology at heart is bound to protest with all his might against the perpetuation of such a solecism as is contained in the sentence we have quoted.

Iron Bridges of Moderate Span, their Construction and Erection. By HAMILTON WELDON PENDRED. (London: Crosby Lockwood & Co. 1887.)—Intended as an instruction book for the practical constructor of iron bridges of some 140 or 150 feet span, we can only regard Mr. Pendred's little volume as the very model of what such a work should be. The formulæ more or less recondite with which modern works on engineering are so largely occupied find no place in his pages, and the working student who opens them in fear that they will be found to swarm and pullulate with equations for the estimation of thrusts and strains will find to his delight that nothing of the sort appears between its two covers. Written by a man quite obviously personally familiar with the minutest details of the operations and materials he describes, this book contains just the kind and amount of information needed to enable its readers themselves to repeat what is so very clearly explained. The work is a credit to "Weale's Series." If we knew of any higher praise, we would bestow it.

Moffatt's Deductions from Euclid. (London: Moffatt & Paige.)—This book consists of no less than 615 "Deductions" from, or supplementary propositions to, those to be found in the first six books of Euclid, and may be heartily commended to all who wish to familiarise themselves with the leading facts of geometry as demonstrated by the Euclidean method. The careful student of the work under notice ought to be able to answer any and every catch question or "rider" likely to be set in an examination in the immortal book to which they form a valuable addendum.

Practical Electricity. By W. E. AYRTON, F.R.S. (London: Cassell & Co. 1887.)—As a thoroughly sound and trustworthy introduction to the science of Quantitative Electricity, it would be difficult to improve upon Professor Ayrton's latest work, containing, as it does, the fullest description both of the theory and practical construction of the instruments employed in electrical measurements. But the reader who goes to its pages for information as to dancing pith-figures, cork spiders, illuminated spiral tubes, and other prettinesses of the whilom lecture table, will be doomed to disappointment; for nothing of the sort appears between its two covers. In its stead he will find a mine of information as to the nature of the electrical current, electro-motive force, potential, &c., and will be able to realise the signification and use of those units of measurement, the ampère, the coulomb, the farad, the ohm, the volt, and the watt. Professor Ayrton's volume is, in short, a reproduction of his first year's course of lectures on electrical engineering delivered to the students at the City and Guilds of London Institute, with the laboratory practice by which they are illustrated. It is a sound and conscientious piece of work.

The Modern Practice of Shipbuilding in Iron and Steel. By SAMUEL P. THEARLE. Vol. I., Text; Vol. II., Plates. (London and Glasgow: William Collins & Co.)—Mr. Thearle has made, in every respect, a worthy addition to the Advanced Science series of Messrs. Collins & Co. in the work now before us. Presumably intended as a text-book for examinees of the Science and Art Department and of the Admiralty, it is really too good for such a purpose, possessing as it does very real merit as a technological hand-book. Its descriptions are exhaustive, and the illustrations leave nothing to be desired. Now that our "hearts of oak" survive only in the chorus of an almost forgotten sailors' song, the practice of iron shipbuilding must possess an interest for all concerned in the maintenance of our maritime supremacy, to say nothing of mercantile shipowners and yachtsmen, who have a special personal concern in it. In fact, all who go down to the sea in ships, or who have to trust their lives to the passenger vessels of the present day, may spend an hour or two very much more unprofitably than in the study of Mr. Thearle's capital treatise and its accompanying atlas. Such study cannot fail to impart intelligent ideas as to the manner in which the floating towns which now connect the most distant parts of the globe are made so staunch, safe, and comfortable as the larger proportion of them undeniably are; for, assuredly, wherever "ignorance is bliss" it is not in the selection of a vessel to make a long voyage in.

Old or New Chemistry. By SAMUEL E. PHILLIPS, F.C.S. (London: Wertheimer, Lea & Co. 1886.)—Mr. Phillips is a man with a grievance. In November 1885 he applied to the Council of the Chemical Society for a pecuniary grant to make numerical analyses of the indium and the gallium alums. In vulgar, but expressive, parlance, the Society "didn't seem to see it." Again in May 1886 he sent a paper to the Society on the Urethane Reaction, only again to meet with a refusal. *Hinc illæ lachrymæ.* In a highly technical series of essays our author exposes (or believes that he exposes) some of the fallacies underlying the new system of chemistry. The very technicality of which we have spoken unfits his little book for popular reading, but it may be commended to such chemists as care to hear both sides of the question.

The Lads of Little Clayton. By R. STEAD. (London: Blackie & Son. 1887.)—This little volume is made up of a series of short detached papers describing, very naturally indeed, the doings and misdoings of the lads of the lower and lower middle classes in an English village some five-and-twenty or thirty years ago. The lads are real flesh-and-blood ones, in many cases rough and even brutal, and their conversation is such as may even now be heard on any village green. Where, as in the majority of cases, any moral is inculcated, it is never obtruded, but springs naturally from the *dénouement.* This would be a first-rate book for a parochial lending library. It is as innocent as it is interesting.

Messrs. Longmans send us *Social Arrows*, by Lord BRABAZON, whose practical efforts to improve the moral condition of our crowded centres by the wholesome material remedies of more open spaces, and to lighten the toil of the overworked shop assistant, have our deep sympathy. *Spirit Workers in the Home Circle*, by MORELL THEOBALD (Fisher Unwin), is illustrated by facsimiles of "direct spirit-writings," and blames the Society for Psychical Research for assuming that it is dealing with phenomena subject to known physical laws. It is, we presume, hopeless after this to commend to Mr. Theobald, with his disregard of Time and Space, Dr. BITHELL'S *Agnostic Problems* (Williams & Norgate), but we may advise the readers of KNOWLEDGE to make acquaintance with it. Of *English as She is Taught* (Fisher Unwin) the cream has already appeared in the *Century Magazine. Edward III. and his Wars* and *The Misrule of Henry III.* (Nutt) are modernised extracts from contemporary chronicles, designed to cover the whole period of Mediæval and Renaissance history. The name of Mr. York Powell as editor is sufficient guarantee of the excellence of the series. We have received new editions of Mr. HERBERT FRY'S excellent guide-book, *London in 1887*, and of Mr. SPENCER'S *Road-Book*, indispensable to the cyclist; Nos. 1–3 of the *Essex Naturalist*, admirably edited, and enriched with a facsimile of Norden's map of Essex, 1594; and *Memoirs of the Imperial University of Japan*, containing some interesting myths and traditions of the Ainos.

Our Whist Column.

BY RICHARD A. PROCTOR.

A WHIST PROBLEM. LEAD OF ACE FROM ACE TO FOUR.

THE whist editor of the *Australasian*, in a note on my discussion of the whist superstition that after a misdeal the next deal will almost certainly give a singleton hand, discusses the question of the probability of a singleton suit in any hand taken at random in any deal. "We showed," he says, speaking of a former inquiry, "that the chance that we should find either a singleton or a blank suit is 7 = 20. Mr. Proctor makes the fraction 4 = 13, which is appreciably smaller."

The difference arises from the fact that the chance of a singleton suit appearing is appreciably smaller than the chance that there will be either a singleton suit or a blank suit. It will be remembered that adding up numbers representing one-fourth of the total number of arrangements by which a singleton suit can appear in a hand (as when the suits are divided 5, 4, 3, 1, or 6, 4, 2, 1, or 6, 3, 3, 1, or the like) I obtained the number 48,882,113,450. To give the chance considered by the whist editor of the *Australasian*, we must add to this number one-fourth the number of all those arrangements in which a blank suit appears, but no singleton (because we have already counted those in which both a blank suit and a singleton appear). Thus we obtain the addition sum:—

Arrangement.	One-fourth of the Number of Hands in which arrangement can appear.
6, 4, 3, 0	2,105,429,040
5, 4, 4, 0	1,973,839,725
5, 5, 3, 0	1,421,164,602
6, 5, 2, 0	1,033,574,256
7, 4, 2, 0	574,207,920
7, 3, 3, 0	421,085,808
8, 3, 2, 0	172,262,376
9, 2, 2, 0	13,050,180
7, 6, 0, 0	8,833,968
8, 5, 0, 0	4,969,107
9, 4, 0, 0	1,533,675
10, 3, 0, 0	245,388
11, 2, 0, 0	18,252
Total	7,730,214,297
Numbers already obtained	48,882,413,150
Total	56,612,627,747
	Multiply by 4
Grand total	226,150,508,988

That is to say, out of the 635,013,559,600 hands which can possibly be held at whist, no less than 226,450,508,988 show either a singleton suit or a blank suit. Thus the chance of any hand taken at random in any deal showing either a blank or a singleton suit is represented by the fraction

$$\frac{226,450,508,988}{635,013,559,600},$$

which differs very little from (it is really slightly greater than) 7-20, the approximation mentioned by the whist editor of the *Australasian*.

In passing, I may remark that I cannot understand a comment made in the *Australasian* upon my approximate estimate that the odds are about 5 to 2 in favour of the appearance of a singleton in one hand at least out of the four distributed at a single deal. The whist editor states that a friend, from the records of an experience extending over five years, had found that the total number of singleton *hands* is about equal to the total number of deals. "We believe, therefore," he proceeds, "that the approximate result which Mr. Proctor has published is under rather than over the mark." My approximate result cannot be tested by counting the number of singleton *hands*; but my exact result relates directly to them. I showed that in 635,013,559,600 *hands*, and therefore for 158,753,389,900 *deals*, there will be 195,529,653,800 hands in which there is at least one singleton, or about sixteen such hands for every thirteen deals. This is above, not below, the result observed in five years' play, unless the "at least" is to be interpreted rather liberally. But a singleton in one or other hand, when singletons are appearing freely, will often escape uncounted.

The article by the *Australasian* whist editor is aimed at the fallacy of supposing that if a player holds Ace and three others (not including the King, or both Queen and Knave) he can safely lead a small one where one trick is necessary to save the game. He wishes me to turn my mathematical deduction to practical account by diverting it from the superstition I attacked to one which affects actual play. For, as he points out, when so long-practised a player as "Pembridge" confidently asserts that the odds are ten to one against "a singleton being on the *tapis* at all," it is evident that very erroneous ideas are held among whist-players on this point, importantly though it should affect whist play.

However, it is not by an inquiry into the average number of singleton hands, or hands with a blank suit, per hands dealt, that the propriety of an Ace lead from Ace to four, under the condition mentioned, can be decided. Taking it for the moment as decided that where one trick saves the game, the question of playing Ace from Ace to four must be decided by the chance of the Ace being ruffed second round, we have in the case of an original first lead a comparatively simple problem—while if other suits have been already opened our problem becomes so complex (having so many varied forms) that no one would care to deal with it. I take, then, the simple problem:—

If A, the original leader, holds four cards in a suit, what is the chance that one or other of the opponents, Y and Z, will be able to ruff the suit second round? apart from the possibility of either getting discards in the suit.

I get the following figures by taking from the table at page 196 of my "How to Play Whist" (which, be it noticed, not only shows how the suits may be distributed in a hand, but how all the cards may be distributed in a suit), the various numbers set opposite the different arrangements mentioned:—

Distribution of cards of a given suit among the four players, one at least holding 4.	One-fourth the number of ways in which the suit can be so distributed.
4, 4, 3, 2	34,213,221,900*
5, 4, 3, 1	20,527,933,140
5, 4, 2, 2	16,795,581,660*
4, 3, 3, 3	16,726,464,040*
6, 4, 2, 1	7,464,702,960
4, 4, 4, 1	4,751,836,375
6, 4, 3, 0	2,105,429,040†
5, 4, 4, 0	1,973,839,725†
7, 4, 1, 1	622,058,580
7, 4, 2, 0	574,207,920†
8, 4, 1, 0	71,775,990†
9, 4, 0, 0	1,533,675†
Total	105,828,585,005
Sum of numbers marked *, cases in which no hand is blank or holds but one card in the suit	67,735,267,600
Sum of numbers of cases in which at least one hand is blank in suit, or holds a singleton	38,093,317,405
Sum of numbers marked †, cases in which at least one hand is blank	4,726,786,350
Sum of numbers of cases in which at least one hand holds but one card	33,438,307,045
Sum of numbers of cases in which *two* hands hold either a singleton or no card in the suit	695,368,245

It will be seen that if we neglect as numerically unimportant the cases in which two hands are void, or hold no more than one card in the suit, we may say that in round numbers there are for 67,700 cases in which the suit will go round twice, 33,400 cases in which it will go round but once, and 4,700 cases in which it will not go round at all. Of these last-named cases, two-thirds, or about 3,130, in which an enemy holds the hand void in the suit, are of course unfavourable to the Ace lead; but they do not affect our judgment, simply because it is certain that the chance of a ruff first round must be risked in any case. (There is, of course, a much greater chance of this happening when Ace is led from Ace to five.) Of the 33,400 cases in which a singleton is held, we may consider at least 400 to be cases where another hand is either void, or holds a singleton, the two hands thus situate being so distributed between *Y*, *B*, and *Z*, that *A B* do not lose through a ruff. This leaves 33,000 cases of a singleton hand in the suit led by *A*, as against 67,700 cases in which the suit will go round twice. Of these 33,000 cases, 22,000 will be cases in which either *Y* or *Z* holds the singleton, and therefore the enemy can ruff the second round of the suit. Thus, by leading a small card *A* will lose the Ace in 22,000 cases out of 67,700 + 33,000 or 100,700, or, roughly, about twice in nine trials, or more nearly, five times in 23.

How far this 2-9th chance of being ruffed second round would justify a player in leading Ace first, to save a game (which might be saved otherwise) at the risk of losing command over the suit, must depend on the details of the hand and game. It is to be remembered that even though *Z*, the fourth player, should be able to ruff, he would not ruff the suit when returned by *B* in every case, only if weak or very strong in trumps. For as *B* would return, generally, a small card, to ruff would be ruffing a doubtful trick.

Our Chess Column.

By "Mephisto."

MATCH BLACKBURNE *v.* ZUKERTORT.

THE result of this match, 5 to 1 in favour of Blackburne, with 8 draws, has rather taken the Chess world by surprise, and must raise the winner in the estimation of those who apprehended that Blackburne never did himself justice when contesting a match. For nearly forty years, that is, ever since Staunton was in his best form, foreign Chess-players were supreme in this country. By this victory, however, Blackburne has avenged his former defeat by Zukertort in 1881, and thereby an Englishman again occupies foremost rank amongst Chess-players. For the time being, unless the coming international tournament should decide otherwise, Blackburne may fairly claim the championship of Europe. The play in the match has been good, and above the average. Appended are some interesting particulars and positions.

Zukertort again relied upon the irregular opening which did him such good service in the London tournament. For the purpose of instruction, and to show the various defences adopted by Blackburne, we give here the opening moves of five of the games, in which Zukertort as first player adopted the irregular attack against Blackburne, namely in the 2nd, 4th, 6th, 8th, and 10th game.

1.	P to Q4	P to Q4	P to Q4	P to Q4
	P to Q4	P to Q4	P to Q4	P to Q4
2.	Kt to KB3	Kt to KB3	P to K3	P to K3
	P to K3	B to Kt5	Kt to KB3	Kt to KB3
3.	P to K3	QKt to Q2	P to QB4	P to QB4
	Kt to KB3	Kt to Q2	P to B4	P to K3
4.	P to QKt3	P to K4	P to QKt3	Kt to KB3
	P to B4	P to K3	B to B4	P to B4
5.	B to Kt2	B to K2	Kt to QB3	P to QKt3
	Kt to B3	P × P	P to K3	Kt to B3
6.	QKt to Q2	Kt × P	B to Kt2	B to Kt2
	B to Q2	KKt to B3	Kt to B3	B to Q2
7.	B to K2	Q to Q3	Kt to B3	B to K2
	R to B sq	P to B3	R to B sq	R to B sq
8.	Castles	Kt to Kt3	B to K2	Castles
	P × P	B to Q3	BP × P	BP × P
9.	P × P	B to Q2	KP × P	KP × P
	B to Q3	Q to B2	B to Q3	P × P
10.	P to B4	Castles KR	Castles	P × P
	Castles	Castles QR	Castles	B to Q3
11.	P to B5	P to B4	P to B5	QKt to Q2
	B to Kt sq	P to KR4	B to Kt sq	Castles
12.	P to QR3	KR to B sq	P to QR3	R to K sq
	P to KR3	P to B4 (*b*)	Kt to K5	Kt to K2 (*d*)
13.	P to QKt4 (*a*)		P to QKt4 (*c*)	

(*a*) White obtained the better game, but lost through indifferent play.

(*b*) Black obtained an advantage, but the game resulted in a draw.

(*c*) Resulted in a draw.

(*d*) Drawn.

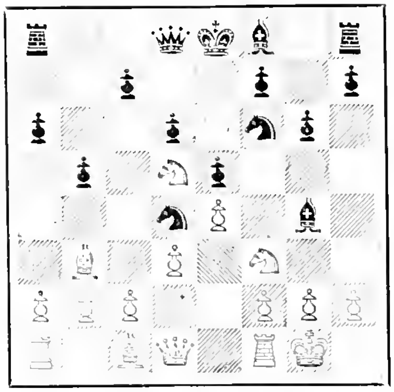
The tenth is a very prettily played game, which we therefore give in full.

WHITE. Zukertort.	BLACK. Blackburne.
1. P to Q4	P to Q4.
2. P to K3	Kt to KB3
3. P to QB4	P to K3
4. Kt to KB3	P to B4
5. P to QKt3	Kt to B3
6. B to Kt2	P × QP
7. KP × P	P × P
8. P × P	B to Kt5 (ch.)
(Inconvenient! White should Castle before playing B to Kt2.)	
9. QKt to Q2	
(B to B3 was requisite.)	
	Kt to K5
10. Q to R4	
(Black threatened Kt × Kt followed by Kt × QP.)	
	Castles
11. R to Qsq	Q to B3!
(Very good! Threatening B × Kt (ch.), and the Kt cannot retake. If B to Bsq then Kt × QP wins.)	
12. B to Q3	
(He must give up the exchange, there is no other move.)	
	B × Kt (ch.)
13. R × B	Kt × R
14. K × Kt	B to Q2
15. Q to R3	KR to Ksq
16. P to R4	P to QR4
17. K to Qsq	Kt to Kt5
18. B to Kt sq	P to K4
(Opening up White's game.)	
19. P × P	Q to B3
20. Q to B3	B to K3
21. P to R3	QR to Qsq(ch)
22. K to Bsq	
(Of course he should have played K to Ksq.)	
23. R to Q6	Resigns
(For if B × R then Kt to R7 (ch.) wins.)	

Blackburne's favourite opening was the Ruy Lopez. In the seventh game the following interesting combination developed itself early in the game. Blackburne, being White, played 1. P to K4, P to K4; 2. Kt to KB3, Kt to QB3; 3. B to Kt5, P to QR3; 4. B to R4, Kt to B3; 5. P to Q3, P to Q3; 6. Kt to B3, P to KKt3; 7. Castles, P to QKt4 (B to Kt2 is the proper move); 8. B to Kt3, B to Kt5; 9. Kt to K5, Kt to Q5.

ZUKERTORT.

BLACK.



WHITE.

BLACKBURNE.

Blackburne was prepared for this move, and continued with

10. Kt × Kt	10. B × Q
11. Kt to B6	

(A very fine combination, such as does not often occur in match play. Of course, if the Queen moves away, then Kt × Kt mate.)

	Kt × Kt
12. Kt × Q	R × Kt

(If instead B or Kt moves, White plays Kt × P.)

13. P × Kt

Best as it secures an advantage for White by blocking Black's game, and forming a strong array of Pawns against the weakened Q's side.

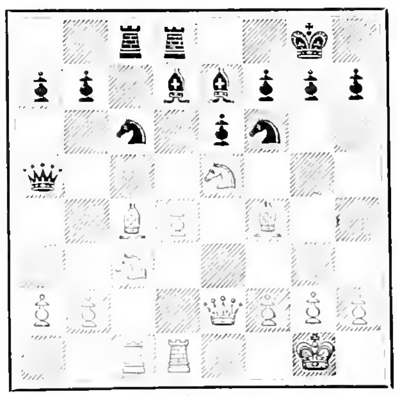
B to Kt5

14. P to QR4. (White won).

The following is another exceedingly interesting position, which occurred in the 13th game, where Blackburne played in a brilliant manner, sacrificing a piece for a fine attack.

ZUKERTORT.

BLACK.



WHITE.

BLACKBURNE.

Blackburne played Kt × P! (An elegant move, and perfectly sound.)

	K × Kt
P to Q5!	P × P
Kt × P	K to Bsq
Kt × Kt	B × Kt
R to Q5	

White might at once have won his piece back by R × B, R × R, Q to K6, R to Ksq, &c., but although White would emerge with a P ahead, the game looked rather drawish, besides the temptation to continue the attack was strong.

P to Q Kt4

A good move, for, if either R or B × P, then Black gains time.

R × P

The position is very rich in possibilities. White might have continued B to QB6 (ch) or R to B3.

Q to R5

P to Kt3	Q to R6
R to Q5	Kt to Q5
R × Kt	
(Extremely bold play.)	
	B × R
R to Qsq	Q to B4
Q to B3	B to B4
P to Kt4	B × BP (ch.)
Black might have forced a win at once by Q to B3.	
K to Bsq	B to R5
R × R (ch.)	R × R
P × B	B to B3
K to Kt2. (The game resulted in a draw.)	

THE FACE OF THE SKY FOR JULY.

By F.R.A.S.

SPOTS continue to appear occasionally on the sun, so that the observer should not relax his watch for them. The sun is in apogee on the morning of the 2nd; or, in other words, the earth is at her greatest distance from him. He of course appears smaller then than at any time during the year. The aspect of the night sky is shown in map vii. of "The Stars in their Seasons." Up to July 21 there is no real night in any part of Great Britain. Mercury is an evening star, and at the beginning of the month may be caught with the naked eye over the W.N.W. part of the horizon after sunset. He is in Cancer ("The Stars in their Seasons," map iii.) throughout the month. He is at his greatest eastern elongation from the sun (25° 51′) on the 1st. Venus, as an evening star, is the most brilliant and conspicuous object in the sky. She attains her greatest elongation east (45° 32′) in the evening of the 13th. She exhibits a beautiful crescent in the telescope now. She will be found in the W. by N. after dusk. She travels across Leo ("The Stars in their Seasons," map iii.) during the month. Jupiter is getting so rapidly towards the west, and is so low down, that he must be looked for the moment it is dark enough. He will be found a very little to the north and somewhat to the east of Spica Virginis ("The Stars in their Seasons," map v.). The certainly visible phenomena of his satellites during July number only twelve. They are as follows:—On the 1st Satellite II. will reappear from eclipse at 10h. 5m. 29s. P.M., as will the third Satellite on the 3rd at 10h. 18m. 54s. P.M. On the 6th Satellite I. will be occulted at 11h. 0m. P.M. On the 7th the shadow of Satellite I will enter on to Jupiter's face at 9h. 33m. P.M., the satellite casting it leaving his opposite limb at 10h. 31m. On the 10th Satellite III. will reappear from occultation at 9h. 29m. P.M. On the 14th the ingress of Satellite I. in transit happens at 10h. 12m. P.M. On the 15th Satellite II. will be occulted at 10h. 11m. P.M., as will Satellite I. at 9h. 17m. P.M. on the 22nd. On the 21th the shadow of Satellite II. will begin its transit over Jupiter's face at 9h. 13m. P.M., Satellite II. itself leaving Jupiter's opposite limb only one minute later! Finally, on the 31st, Satellite I. will reappear from eclipse at 9h. 6m. 43s. Neither Saturn, Uranus, nor Neptune is, for the observer's purpose, visible. The Moon is full at 8h. 34·2m. in the morning on the 5th, enters her last quarter at 6h. 57·1m. A.M. on the 13th, is new at 8h. 50m. P.M. on the 20th, and enters her first quarter at 2h. 30·3m. in the afternoon of the 27th. Six occultations of fixed stars by the Moon will occur at tolerably convenient hours for the amateur observer during July. On the 1st, η Libræ, a star of the 6th magnitude, will disappear at the Moon's dark limb at 9h. 23m. P.M., at an angle from her vertex of 19°; reappearing at her bright limb at 10h. 1m. P.M., at an angle of 320° from her vertex. On the 6th, B.A.C. 7053, a 5½th magnitude star, will disappear at the bright limb of the Moon at 9h. 49m., as will o Capricorni, also of the 5½th magnitude, simultaneously. At the time of their disappearance B.A.C. 7053 will be 37°, and o Capricorni 38° from the vertex of the Moon. The first-named star will reappear at the Moon's dark limb at 10h. 53m. P.M., and the second at 10h. 54m. P.M., both at a vertical angle of 280°. On the 8th, 42 Aquarii, of the 6th magnitude, will disappear at the bright limb 48 minutes after midnight, at a vertical angle of 43°. It will not reappear until about a quarter to 2 o'clock the next morning. On the afternoon of the 17th, an occultation of Aldebaran will happen in bright sunshine, the star disappearing at the bright limb of the Moon at 3h. 16m., at an angle of 139° from her vertex, and reappearing at 3h. 33m. at a vertical angle of 172°, of course at the dark limb. On the 25th, B.A.C. 4277, of the 6th magnitude, will disappear at 8h. 20m. P.M., at the Moon's dark limb, at an angle of 34° from her vertex, reappearing at her bright limb at 8h. 15m., at a vertical angle of 350°. Finally, on the 31st, 21 Sagittarii, of the 5th magnitude, will disappear at the dark limb at 12h. 23m P.M. The reappearance at the bright limb will not happen until between 1 and 2 o'clock in the early morning of August 1. When our notes begin the Moon is in Libra, but at 5h. 30m. A.M. on the 2nd, she has arrived at the western edge of the narrow northern spike of Scorpio ("The Seasons Pictured," plate xxvi.). By 2 o'clock the same afternoon she has crossed this and emerged in Ophiuchus. Her passage over this constellation occupies her until 6h. A.M. on the 4th, when she enters Sagittarius. She is travelling through Sagittarius until 2h. P.M. on the 6th, when she quits it for Capricornus ("The Seasons Pictured," plate xxi.). Her journey across Capricornus terminates at 4h. P.M. on the 8th, and she then passes into Aquarius. Here she remains until 7h. P.M. on the 10th, when she enters Pisces ("The Seasons Pictured," plate xxii.). From about 7h. P.M. on the 11th to 11h. P.M. on the 12th she is in the confines of Pisces and Cetus, but fairly enters Pisces again at the hour last named. Twenty-four hours later she has crossed again into the northernmost part of Cetus, which she finally quits for Aries at 6h. 30m. P.M. on the 14th. It takes her precisely 24 hours to cross the constellation last named, and at 6h. 30m. P.M. on the 15th she passes into Taurus ("The Seasons Pictured," plate xxiii.). Travelling through Taurus, we find her at 1h. 30m. in the afternoon of the 18th on the confines of the northern part of Orion; 12 hours later she has traversed this and come out in Gemini ("The Seasons Pictured," plate xxiv.) She is travelling through Gemini until 6 P.M. on the 20th, when she enters Cancer; quitting Cancer, in turn, for Leo at 5h. A.M. on the 22nd. She is in Leo until 4h. P.M. on the 24th, at which hour she crosses the boundary into Virgo ("The Seasons Pictured," plate xxv.). It takes her until 3h. P.M. on the 27th to traverse this large constellation, and at that hour she passes into Libra ("The Seasons Pictured," plate xxvi.). Then, as at the beginning of the month, we find her at 11h. A.M. on the 29th on the edge of the narrow northern strip of Scorpio, and this she leaves at 8 o'clock the same evening for Ophiuchus. At 1 o'clock in the afternoon of the 31st she has quitted Ophiuchus for Sagittarius, and is, of course, in Sagittarius when the month closes.

The London Stereoscopic Company purpose holding their Third Annual International Amateur Photographic Exhibition in October next, when a sum of 50*l.* in cash and a number of gold, silver, and bronze medals will be offered as prizes. Captain W. de W. Abney, F.R.S., as president, and the editors of the *Camera* magazine and of the *Amateur Photographer* have undertaken to act as judges, together with two to be appointed by the plebiscite of the exhibition. The exhibition is under the patronage of several influential amateurs. The whole of the entrance fees will be given in full to the Photographers' Benevolent Association, and we think this idea of the Stereoscopic Company a good one; for while so many wealthy persons are interested in the art, it is well that they should from time to time be reminded of the existence of their less fortunate professional brethren. All particulars relating to the exhibition can be obtained by application to the Company's Secretary, 108 and 110 Regent Street, London, W.

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BACON AND SCIENCE.

THERE is a widely prevalent belief that Lord Bacon was the originator of inductive philosophy—the father of the modern scientific method. This idea is so generally entertained that to many it will appear like paradox to question it. We have been told again and again that it was as followers of the Baconian method that Pascal and Torricelli determined the properties of air; that Newton was a disciple of Bacon and was directed by Baconian hints when he quarried from out the unknown the grand law of gravitation. "Nurtured in Bacon's school," says a modern enthusiast, "Boyle transformed hydrostatics from a loose assemblage of facts into a deductive science; Watt constructed the steam-engine, which has annihilated space and economised the labour of millions, and Franklin rivalled the glories of the ancient Prometheus in snatching the electric fire from heaven."

In reality, the influence of Bacon in starting and guiding modern science is little better than a myth. The common opinion on the subject justifies the old saying, *Communis opinio communis error.* No competent student of science acquainted with Bacon's own promises and anticipations regarding his method has ever adopted this error, though many students of science unacquainted with Bacon's works imagine that he really originated the modern scientific method, and all such students of Bacon's works as have little knowledge of the history of scientific research imagine that the inductive method he devised and described is the method which Pascal and Newton, Watt, the Herschels, Laplace, Darwin, and other great leaders of science have followed in effecting the discoveries which have made their names illustrious.

The world owes much to Bacon, but not this. Science owes not a little to him, but assuredly not her method. It can be more certainly shown that Bacon was not the inventor of the modern scientific method than that he was not the author of the plays attributed to Shakespeare—and this, in my opinion, is saying a great deal. But if this should by some be thought little, then I will use another comparison, and say it is as certain that Bacon was not the father of modern science as that he—Ptolemaist as he was to the backbone—was not the discoverer of the Copernican theory, the earliest product of the modern method, published to the world seventeen years before he was born.

The most striking proof of the essential difference between Bacon's method and the actual method of scientific inquiries is the marked failure of Bacon's anticipations in regard to what his method was to effect. Said Bacon (I follow Spedding's translation): "The course I propose for the discovery of sciences is such as leaves but little to the acuteness and strength of wits, but places all wits and understandings nearly on a level. . . . For my way of discovering sciences . . . performs everything by the surest rules and demonstrations." Assuredly no such levelling of wits as Bacon anticipated has come about. No small mind has accomplished great results by his method—nor, indeed, any great mind either.

What, then, was Bacon's method? and what is the method of all true science, alike in ancient and modern times?

There can be no knowledge of nature without observation and experiment. That is the golden rule of science. Had Bacon discovered and announced that, first of all men, to the world, he would assuredly have deserved all that has been said of him by men either not knowing what he actually said or how science has actually advanced. Had that been the blow by which Aristotelian methods were attacked, Bacon would have justly been regarded as one who had overthrown a false system of philosophy by a well-delivered and most effective stroke. But it was not Bacon who enunciated first, still less was it he who first recognised, that golden rule. Recognised we know not how far back—but Chaldean astronomers and Egyptian architects must have had a very clear idea of it ages before the law was enunciated—it was insisted upon by no other than Aristotle himself.

Because Bacon attacked Aristotle's system of logic, and did much to diminish its influence in the schools, it is commonly understood that he overthrew the Aristotelian philosophy. As a matter of fact, Bacon was in error even in attacking the Aristotelian syllogistic system. In so doing he forgot the sound principle, *Abusus non tollit usum* (or, as Guy Mannering translates it, "the abuse of anything doth not abrogate the lawful use thereof"). He fell into special error in denying the use of the syllogistic method in regard to the system of inductive inquiry which he advocated, the effective application of which must depend absolutely on the very method Bacon scorned.

There can be no knowledge of nature until all possible observations and experiments have been made—this, though not in so many words, was the principle on which Bacon insisted. You must have all your facts, and sort them all into their several compartments. Then will the true theory be recognised by its agreement with all known facts, either absolutely or relatively, according to its different details and the bearing of the various orders of facts upon them. As certainly as the true key to a complicated lock may be recognised by its correspondence with all the wards when you have taken the lock to pieces and carefully compared each part, ward by ward, with the key, so surely can the one only true explanation of the facts relating to a subject of inquiry be recognised when you have examined the subject in all possible lights and compared all the facts, detail by detail, with the theory. All possible positive instances and negative instances, as well as instances partially positive and partially negative in greater or less degree (no less than twenty seven classes or instances were indicated by Bacon), must be collected and compared with each admissible theory; then will the true theory show itself—to the levelling of unequal wits, as well as to the advancement of scientific learning.

The method has not only *not* brought unequal wits to a common level, it has never enabled any man, let his genius be ever so great, to arrive at truth. Not one discovery in science has ever been made by this method. No student of science familiar with the complication of details existing in all the problems of nature, even in some which appear the simplest, would ever have thought of suggesting the inductive method as recommended by Bacon. No student of science has ever even begun to apply the true Baconian method—unless, indeed, we consider Bacon himself as one who tried the method, laying himself open to the well-merited stroke of the great deductive (or rather, deductively inductive) philosopher Harvey, who said to him: "Bacon writes philosophy like a Lord Chancellor." Any one who wishes to see what utter nonsense may be deduced by one attempting to apply the true Baconian method of induction should read Bacon's discussion of heat in the second book of the "Novum Organum." The gathering of instances is full of mistakes such as even in his day should have been impossible; their classification and comparison introduces the wildest and most fanciful notions: the "vintage" is worthy of the bad fruit and the poor classification. After thirty or forty closely printed pages of misapprehended facts and delusive reasoning, Bacon arrives at this noteworthy conclusion:—

"Heat is an expansive motion restrained, and striving to exert itself in the smaller particles: the expansion is modified by its tendency to rise, through expanding towards the exterior, and the effort is modified by its not being sluggish, but active and somewhat violent."

Of course, those who can find Harvey's discovery of the circulation of the blood and the Copernican theory of the solar system in Shakespeare may very well imagine that Bacon's definition of heat as an "expansive motion restrained" was a splendid anticipation of the modern theory that "heat is a mode of motion." In reality the modern theory of heat would be just as certainly and absolutely negatived if Bacon's imagined facts were real ones, or if his definition of heat as above quoted were sound, as the Copernican theory would be negatived if the ideas expressed by Ulysses in "Troilus and Cressida" were just, and as the circulation of the blood would be disproved if the account of the office of the blood given by Menenius Agrippa in the first scene of "Coriolanus" were correct. The poor "vintage" resulting from Bacon's discussion of heat is as much like the theory based on the researches of Ampère, Laplace, Mayer, Magnus, Joule, Rumford, and the rest, as bad vinegar is like the best Burgundy, or the dregs of a bottle of British "gooseberry" like a freshly poured glass of Veuve Clicquot. Not even the very beginnings of the modern science of heat can be traced in Bacon's definition; the laws of convection, conduction, and radiation of heat are as utterly absent as the more advanced developments of the science — Prevost's theory of exchanges, the laws of specific heat, the kinship between heat, light, electricity, and chemical action, and the like. The very circumstance that the modern theory of heat can be imagined to exist under Bacon's definition is the best proof of the worthlessness of a definition which is so vague that any theory of heat whatever might have been equally well supposed (by the ill-informed) to underlie it.

It may be interesting to compare with Bacon's attempt to employ his own system effectively such scientific discoveries as Newton, Harvey, or Darwin have achieved by that combination of deductive and inductive methods which alone has led to any real progress in science from the days of the science students of Babylon, Egypt, and India to the present time. I take the work of Newton as that which falls most fully within my own range of study, and in dealing with which I can best recognise how much or how little Bacon had to do with the result achieved.

To begin with, note that the discovery of the law of gravity was the culmination of a series of discoveries.

To go no farther back than the time of Copernicus, it is evident that we have in the Copernican theory a necessary predecessor of the theory of gravity. That Copernicus died seventeen years before Bacon was born affords, as I have already suggested, a tolerably clear proof that the Baconian method was not essential to the achievement of great scientific discoveries. *Vixere fortes ante Agamemnona multi*—there were many strong men before Agamemnon, many great thinkers before Newton. The Copernican theory was established by that fruitful combination of deduction and induction to which I have just referred—induction having had a somewhat larger share than usual in the work, since undoubtedly astronomical observations were carried on much longer than they need have been before analysis was applied to the evidence collected and its true meaning deduced. Here was proof, before Bacon described his method, of its worthlessness; for all the multitudinous observations of the planets before Copernicus's time had led only to greater and greater perplexity and confusion worse confounded, "centrics and eccentrics, scribbled o'er cycle and epicycle, orb in orb." But, oddly enough, Bacon himself has shown how valueless his method was by which the mere multiplying of observations was to be trusted for the educing of new truths. For though, as Mr. Ellis (one of the few competent men of science who has ever dealt with Bacon's claims) points out, "Bacon paid great attention to astronomy, discussed carefully the methods in which it ought to be studied, and constructed for the satisfaction of his own mind an elaborate theory of the heavens," his theory was purely Ptolemaic and altogether erroneous.

If the theory of Copernicus, while based on an exceptional amount of inductive evidence, was nevertheless a triumph of the deductive method, the work of Kepler was exceptionally, and indeed unduly, deductive. He was not willing to examine facts with sufficient patience before conceiving theories, but with amazing liveliness of imagination conceived theory after theory and then sought for facts whereby to test them. If he had not been controlled by singular self-restraint, leading him to submit his favoured fancies to the test of observation, and to give them up one after the other as observation decided against them, Kepler would have achieved no success. But fortunately his self-restraint in this respect was as remarkable as his freedom from all restraint in theorising. Nothing seemed more incautious than his theorising; but then nothing could have been more cautious than his investigation of his theories, or more thorough than the tests to which he subjected them.

Galileo was a disciple of the sounder scientific school. His labours, quite as necessary precursors of Newton's work on the physical side as Kepler's on the astronomical, were conducted on the truest principles. All his theories were suggested by observation (not one of Kepler's was), and they were all in turn tested by observation. The operation of terrestrial gravity in particular (despite the nonsensical story of Newton and the apple) was thoroughly mastered by Galileo, applying throughout the method of scientific research by which all the scientific discoveries of modern times have been effected. Assuredly Galileo borrowed nothing from his contemporary, the English Lord Chancellor.

When the way had been duly prepared, Newton entered on his great task. Let us consider what he did, and how he did it. A philosopher of the true Baconian type, Flamsteed, the Astronomer-Royal, was collecting at Greenwich multitudinous observations of the heavenly bodies—a work which might have gone on, even as the modern meteorological observations at Greenwich and elsewhere have gone on, till millions of observed facts had been collected and nothing learned. Newton, who knew that the planets move according to certain laws around the sun, and the moon—not recognisably under the same laws—round the earth, and further, that bodies are drawn towards the earth by the force of terrestrial gravity, was led—not by Flamsteed's collection of facts, not by gathered facts at all, but by a happy thought based on pre-established theories—to inquire whether terrestrial gravity might not be an example of a property possessed by matter itself; whether the earth's attractive power might not extend to the moon, and be shared by the sun in such greater degree as corresponded with the sun's greater mass.

While the suggestion of these thoughts was independent altogether of any such gathering of evidence as the Baconian method required, the testing of the theory thus suggested was a work of pure deduction. Observations were employed, indeed; but they were such observations as the theory itself suggested. And the way in which the selection of observations for this special purpose was determined was not only deductive, but depended on such deductions as only a man of Newton's power could have formed.

Newton ascertained, first by means of mathematical methods of his own devising, that if a force or attraction residing in the sun determines the movements of the planets according to the laws ascertained by Kepler, that force must vary according to the law of the inverse squares—that is to say, the force diminishes as the square of the distance increases. He calculated what the earth's known attractive power, diminishing according to this law, would be at the moon's distance; and he found (after a long delay, due to the inexact observations and measurements of others) that under an attractive force, so diminishing with distance, the moon would travel around the earth as she actually does.

But Newton went much further than this. He made experiments and observations to see if this attractive force resides in all matter, and is always proportional to the mass or quantity of matter. He then discussed the details of the moon's movements—peculiarities which had long perplexed astronomers, had long afforded them the means, if Bacon was right, of educing the true theory of her movements, and had all the time taught *nothing*.

It was not the consideration of these peculiarities, not the induction of these observed facts, which led Newton to the true theory. On the contrary, the true theory was deduced from considerations applied to laws already discovered deductively by others; and the true theory led Newton to consider observed facts and peculiarities.

Newton went further, however, even than this. By pure deduction from his theory he showed that the moon's movements around the earth ought to be affected by certain minor peculiarities caused by the sun's perturbing action, and he invited Flamsteed to ascertain if such peculiarities really exist.

Flamsteed, thus guided, was able to supply the required evidence. As Professor De Morgan well remarked of the achievement, "Had it not been for Newton, the whole dynasty of Greenwich astronomers, from Flamsteed to Airy, might have worked away at nightly observation and daily reduction without any remarkable result, looking forward, as to a millennium, to the time when any man of moderate intelligence was to see the whole explanation"—a time which would never have come, whatever a believer in the Baconian method may imagine.

There is no evidence that Newton ever paid attention to aught contained either in Bacon's "Advancement of Learning," or in the "Novum Organum." But Newton's work suffices to make it absolutely certain that if he ever did weigh Bacon's method he found it wanting, for he followed a course of the very kind which Bacon had condemned, and carefully avoided the course Bacon had recommended. Moreover, as I wrote in 1865, Newton's success afforded a marked and early illustration of Bacon's error in supposing his system of philosophy would raise all its followers to one level, however various might be their talents and capacities. For of Newton it may justly be said that in genius, as in the work he accomplished, *genus humanum superavit.*

THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

By Edward Clodd.

PART II.

CHAPTER VI.—(*Concluded.*)

"THAT many and serious objections may be advanced against the theory of descent with modification through variation and natural selection, I do not deny. I have endeavoured to give them their full force." * The sixth, seventh, and tenth chapters of the "Origin of Species" are proof of this. Darwin shirked no difficulty, and in laying stress upon whatever told against his theory he made its foundations more sure. One great, but unduly overrated, stumbling-block—the absence of intermediate forms in the fossil-yielding rocks—has been removed by the discovery of many more connecting links in the long chain of life than could be expected when we take into account the small minority of fossils which have escaped the havoc of the past, and when we remember how much smaller are the chances in favour of the preservation of the more fragile, rare, and unstable transitional forms than of the species which they connect.

Another leading objection, drawn from the barrenness of hybrids,† as, *e.g.* of the mule, loses much of its force in view of the numerous examples to the contrary, both in plants and animals, as amongst genera of the thistle and of the laburnum, and as in the cases of fruitful hybrids of sheep and goats in Chili, and of hares and rabbits in France.‡ But, as against natural selection, the real difficulty lies in the inter-breeding of species developed by selective breeding from a common stock. For example, the different species of pigeons have been developed from the wild rock-pigeon, and these are fertile with one another, which would seem to tell in favour of the fixity of species, unless the carrier, pouter, and tumbler are, after all, to be regarded only as varieties or subdivisions of species.§ The matter, however, is too abstruse for these papers, and, moreover, it has no weight as against the theory of derivation. We know very little as to the complex conditions ruling fertility and barrenness; we know that the reproductive organs are peculiarly sensitive to altered habits and surroundings, and we know further, that it is through changes in those organs that the barriers to interbreeding have arisen, and the consequent multiplication of countless intermediate varieties been arrested. Happily, the Darwinian theory has no fatal element of rigidness in it, and those who would mould it into a dogma know not what spirit they are of. It admits of alterations in detail at the behest of fresh facts, and of such correction of proportion as time alone gives to things new and near. But the truth of the theory of which it is a subordinate part will thereby stand out the clearer, and the full accord of past and present to the oneness of things appear more manifest.

* "Origin of Species," p. 404.

† "Animals and Plants under Domestication," vol. ii. pp. 130–156, and chap. xix., *passim*.

‡ Haeckel's "History of Creation," vol. i., pp. 145–148.

§ No one definition of "species" has satisfied all naturalists, and the term "variety" is almost equally difficult to define, but, practically, when a naturalist can unite by means of intermediate links any two forms, he treats the one as a "variety" of the other, ranking the most common, but sometimes the one first described, as the "species," and the other as the "variety." Cf. "Origin of Species," p. 33.

CHAPTER VII.—SOCIAL EVOLUTION.

Evolution of Mind.—If the theory of Evolution be not a universal, the germs of decay are in it. And here we pass from what is interesting to what is of serious import for us, because if the phenomena of mind are not capable of the like mechanical explanation as the phenomena of stars and planets and of vegetable and animal life, Evolution remains only a speculation to fascinate the curious. It can, in that case, furnish no rule of life or motive to conduct, and man, "the roof and crown of things," would be the sole witness against their unity and totality. If there be in him any faculty which is no part of the contents of the universe, if there be anything done by him which lies outside the range of causation, then the doctrine of the Conservation of Energy falls to pieces, for man has the power to add to that which the physicist demonstrates can neither be increased nor lessened.

The ground covered in former papers need not be retrodden to show that man is one in ultimate beginnings, and in the stuff of which he is made, with the meanest flower that blows, and that in mode of development from the egg to the adult state there is exact likeness between him and other mammals. But some repetition of the process of mental development from the lowest life-forms to the highest is needful.

"Structure for structure," remarks Professor Huxley, "down to the minutest microscopical details, the eye, the ear, the olfactory organs, the nerves, the spinal cord, the brain of an ape, or of a dog, correspond with the same organs in the human subject. Cut a nerve, and the evidence of paralysis, or of insensibility, is the same in the two cases; apply pressure to the brain, or administer a narcotic, and the signs of intelligence disappear in the one as in the other. Whatever reason we have for believing that the changes which take place in the normal cerebral substance of man give rise to states of consciousness, the same reason exists for the belief that the modes of motion of the cerebral substance of an ape, or of a dog, produce like effects." *

But let us begin at the bottom of the life-scale. The lowest things, being organless, or alike all over, respond to touch, "the mother-tongue of all the senses," in every part, simply changing their shape from moment to moment. A step higher we find forms in which unlikenesses in parts begin to show themselves—*e.g.*, in the formation of a layer at the surface—and here the responses to the stimuli, as they are called, become localised, because the movements of the stimuli take place, like all modes of motion, along the lines of least resistance. These movements give rise to changes in the structure of the organism, driving the molecules out of their places, and, following in incredibly rapid succession, finally lay down permanent nerve-tracks, built up of the more sensitive parts of the skin. All sense-organs, whether the whiskers of a cat or the eye of a man, all the wondrous network of nerves and the brain itself, have thus originated. Practice makes perfect; and, as the result of their incessant repetition, the lowest and simplest nerve-actions, known as *reflex*, take place automatically in plants and animals. Such are the contractions of an amœba or of the leaves of a mimosa; breathing, the action of the heart, winking of the eyes—in short, all actions that are performed unconsciously, and which are repeated in virtue of the tendency to do them being innate in the structure which each organism inherits from its ancestors. Besides these natural reflex actions, there is a group of artificial reflex actions which our higher intelligence enables us to acquire, as the arts of reading, playing instruments, &c.

As everyone knows, it takes a soldier a long time to learn his drill—for instance, to put himself into the attitude of "attention" at the instant the word of command is heard; but, after a time, the sound of the word gives rise to the act, whether the soldier be thinking of it or not. There is a story, which is credible enough, though it may not be true, of a practical joker, who, seeing a discharged veteran carrying home his dinner, suddenly called out "Attention!" whereupon the man instantly brought his hands down, and lost his mutton and potatoes in the gutter. The drill had been thorough, and its effects had become embodied in the man's nervous structure. The possibility of all education is based upon the existence of this power, which the nervous system possesses, of organising conscious actions into more or less unconscious, or reflex, operations.*

Instinct is a higher form of reflex action. The bird makes its nest or migrates from one zone to another by an unvarying route; the bee builds its six-sided cell; the chick breaks its way through the shell, balances itself, and picks up grains of corn; the new-born babe sucks its mother's breast, all in virtue of like acts on the part of their ancestors, and which, arising in the needs of the creature and gradually becoming instinctive, have not varied during long ages, the tendency to repeat them being transmitted within the germ from which bee and bird and man have severally sprung. But, as Gilbert White remarked more than a century ago, "the maxim that defines instinct to be that secret influence by which every species is compelled naturally to pursue at all times the same way or track without any teaching or example, must be taken in a qualified sense, for there are instances in which instinct does vary and conform to the circumstances of place and convenience." † Herein that delightful writer, without suspecting what he was conceding to the brute, indicates where instinct passes into *Reason*. For the main difference between the two is that, while the one is done because the animal cannot help doing it, the other is the conscious adjustment of means to ends, of selection as the result of reflection. In the one there is no pause, in the other there is a measurable interval, hence the stimuli to action are more complex and less rapid, giving time for that perception of likenesses and unlikenesses in things which is essential to conscious action. Further than this we need not now follow those processes of chemical changes in the molecules of the brain which, in ways we know not, result in consciousness. It suffices to say that whereas the lower animals, for the most part, start fully equipped for their functions, and rarely pass beyond them, a few higher approach man, *longo intervallo*, in having to pass through a period of helplessness, because the brain and connecting mental apparatus are not complete at birth.

In this lies the explanation of that capacity for teachableness, for profit from experience, which, although no special endowment of man, is his in immeasurable degree compared with the animals nearest to him in development. And since the knowledge that is gained and the habits that are acquired in early life abide with us, and determine character, therein lies the importance to ourselves and to others of learning what is true and of cultivating what is good.

Enough has been said to show that, vast as are the differences between the highest and lowest mental actions, there is no break in the series which, starting with the reflex movements of an amœba or of a carnivorous plant, advances along the line of animal instinct and intelligence, and ends with the complex movements of the brain of civilised man, with its infinite modes of response to infinite stimuli.

Evolution of Society.—Like every other species, man tends to vary, and also to multiply at a rate beyond the means of subsistence. Myriads of human beings perish every year in a few hours or days after birth; vast numbers die in early childhood; wars, pestilences, famines, and catastrophes decimate at intervals the populations of empires. Natural selection weeds out the least fit, and

* Hume, p. 105.

* Huxley's "Elementary Physiology," p. 306.

† "Natural History of Selborne," Letter lvi. to Mr. Barrington.

although under civilised conditions the weak and diseased are coddled, and even multiply their kind, this check is too local to affect the larger result, while that which the race might gain in physique by its removal is not to be compared to the loss that would ensue from the repression of mercy and sympathy. In a barbaric society weaklings like Newton and hunchbacks like Pope would have been left to perish; civilisation spares them, and humanity is enriched by their genius.

As the chief difference between man and his nearest congeners, the highest apes, is in the size and creases of the brain, brain-capacity being the measure of advance in the life-scale, it follows that he has reached the topmost place through the action of natural selection in the modification of his brain more than of his body, for his erect position and modification of the fore feet into hands were due to his superior intelligence, mind ruling function, and function ruling structure. Whichever among the arboreal creatures from whom he is descended possessed any favourable variation, however slight, in structure of brain and sense-organs, would secure an advantage over less favoured rivals in the struggle for food and place and mates. The qualities which gave them success would be transmitted to their offspring, the distance over their competitors gained in one generation would be increased in the next, brain-power conquering brute force, skill outwitting strength, till the chasm between man and the highest ape, and ultimately between man savage and man civilised, became impassable.

For in following the evolution of mind to its highest operations and results, the comparison lies between the several races of mankind. Darwin says that he does not believe it possible to describe the difference between savage and civilised man. "It is the difference between a wild and tame animal, and part of the interest in beholding a savage is the same which would lead every one to desire to see the lion in his desert, the tiger tearing his prey in the jungle, the rhinoceros wandering over the wide plains of Africa." He describes the Fuegians, who rank amongst the lowest savages, as men "whose very signs and expressions are less intelligible to us than those of the domesticated animals—men who do not possess the instinct of those animals, nor yet appear to boast of human reason, or at least of arts consequent on that reason." * Such races are much nearer to the ape than to the Caucasian.

The fundamental likeness between the varieties of man evidence that the physical and mental differences which mark him from the highest apes had been acquired before his migration from the place of his origin and development, wherever that may have been. That migration, however, occurred long enough ago for the play of causes effecting the enormous differences just named. But we can only infer from the condition of existing savages what "primitive" man was like. Doubtless he was lower than the lowest of these—a biped, with powerful sense-organs (always keener, in virtue of constant exercise, in the savage than in the civilised, who supplements them by science), strong instincts, uncontrolled and fitful emotions, small faculty of wonder and nascent reasoning power; unable to forecast to-morrow or to comprehend yesterday, living from hand to mouth on the wild products of nature, and finding shelter in trees and caves, ignorant of the simplest arts, save to chip a stone missile and, perhaps, to produce fire, strong in his need of life and vague sense of right to it and to what he could get, but slowly impelled by common perils and passions to form ties, loose and haphazard at the outset, with his kind, the power of combination with them depending on sound-signs and gestures.

* "Naturalist's Voyage Round the World," p. 504.

Such, in broad outline, was probably the general condition of the earliest known wanderers, the relics of whose presence—rudely-fashioned stone tools and weapons—are found associated with the bones of huge extinct mammals, as the mammoth and the cave-lion, in old river-beds and limestone caverns. As the successive deposits and their contents show, not till long ages had passed, bringing new and settled conditions, with knowledge of agriculture, metals, and other useful arts, do we find any marked progress among mankind. Even that progress, great and not unchecked, as both ancient and modern civilisations witness, has been confined to a minority of the species and to a narrow zone, while, compared to the antiquity of man, it is but as yesterday. The enterprise of the higher races has explored and utilised large tracts, and the pressure of population at the centres of civilisation has within quite recent periods vastly extended their radii, but whole empires, advancing to a certain stage, have through isolation and the tyranny of custom, or dread of change, stagnated, whilst the lowest races have remained unmodified, like the lowest organisms, and have more or less succumbed before the imported vices and the weapons of the white man. But the causes of arrest and of advance are alike complex; man, like every other living thing, is the creature of outward and inward circumstances, and many influences have worked in the shaping of his destiny. Certainly, extremes of climate have been fatal to advance beyond a given stage; it is in the temperate zones that the incentives exist to continuous and indefinite progress.

Man by himself is unprogressive; therefore his advance is due to the cultivation of the social instincts. "There is a wonderful spirit of sociality in the brute creation, independent of sexual attachment," wrote Gilbert White in 1775, and Darwin remarks that "the social animals which stand at the bottom of the scale are guided almost exclusively, and those which stand higher in the scale are largely guided, by special instincts in the aid which they give to the members of the same community; but they are likewise in part impelled by mutual love and sympathy, assisted apparently by some amount of reason." * In the degree that animals are social, we find them higher in the scale, as ants, bees, and wasps among insects; and, among domestic animals, dogs, whose wild ancestors hunted in packs, as compared with cats, which inherit the more solitary and wandering habits of their wild ancestors.

Man inherits the social instincts of a remote ancestry. Farther back than the records of his presence take us, he found strength in unity, and the more so in virtue of his physical inferiority to many animals. His normal state was one of conflict, both with them and with his own species, for Carlyle's remark that "the ultimate question between every two human beings is, 'Can I kill thee, or canst thou kill me?'" is true of every stage of man's history. The struggle is all along the line: it may change its tactics and its weapons; among advanced nations the military method may be more or less superseded by the industrial, and men may be mercilessly starved instead of being mercifully slain, but, be it war of camps or markets, the ultimate appeal is to force, and the hardiest and craftiest win. But they that have hope of their kind believe that these shall not always prevail.

We do not know what the earliest social unions were like. Probably there were no family arrangements as we understand the term, but only various kinds of relations, more or less fugitive, between groups of men and women. The details, however, do not affect the general fact of social intercourse, in which community of interest was the binding

* "Descent of Man," p. 109.

force. Impetus was given to more personal and permanent relationships by the longer period of infancy in man as compared with the same period in the man-like apes, in whom, again, it is much longer than in monkeys.* For as the maternal instinct "sublimes the passions, quickens the invention, and sharpens the sagacity of the brute creation,"† so this period of helplessness would draw parent and child closer together, evolving love and sympathy, and developing those enduring and exalting relations of the family which widened into tribal life. Struggles against common foes brought the bravest to the front as leaders, turbulent elements within involved the rule of the ablest, disputes called for the settlement of the wisest, and thus the foundations of law and order were laid.

Evolution of Language, the useful Arts, and Science.— Two things markedly separate man from brute—his erect attitude, whereby the hand, no longer an organ of support, is left free to carry out the behests of the mind; and language. Not that the "dumb" animals, as they are called, are all voiceless: many of them have no small or inexact gamut of sounds by which to express their emotions, their love-calls, and their danger-cries. But although these may be not more unintelligible to us than the language of savages like the Fuegians, which Captain Cook compared to a man clearing his throat, the fact abides that language, as the symbol of ideas, as the means of conveying thought from mind to mind, marks the impassable gulf between the mental capacity of man and all lower animals. Its origin lies in his need to communicate with his fellows, and but for it all attempts after social union would have been as the weaving of a rope of sand.

Words themselves reveal under analysis the history of their origin from a few formless root-sounds, which were instinctive cries or imitations of various natural sounds, very largely aided at the outset by signs and gestures. To this day, gesture-language is the sole mode of communication between certain wandering tribes of American Indians, and there are other tribes whose stock of sound-signs is so limited that they cannot understand each other in the dark. We can never know what the first sound-signs were like, but their choice and currency obviously depended on the success with which they conveyed the meaning of those who invented them, which, of course, applies to every stage of language, from the simple names of objects with which it began to the ultimate transfer of those names to ideas. For all abstract terms have a concrete base. Certain it is that from mimetic sounds, with their boundless variety of modulation, there have been developed not merely the scanty and shifting speech of the lower races, but the wondrously rich, copious and ever-growing languages of civilised races, the sound-carriers not only of man's common wants, but of the lofty conceptions which are enshrined in prose and poetry, and without which, now made the common intellectual wealth of nations through the arts of writing and printing, how poor and dwarfed would human life have been! Language has, therefore, followed the common law of Evolution in advance from the simple to the complex, proving itself to be one of the many instruments which the skill of man has perfected from raw materials as his social needs have multiplied and as his intelligence has increased.

And the like adaptation of means to ends applies to the development of the useful arts, as well as of those arts in which the head is more concerned than the hand. The primal needs of clothing and shelter, of weapons of war and of the chase—for the sword and bow precede the spade and hammer—the need, under more settled conditions, of implements for the household and the field, set man's wits at work to supplement and improve that which nature supplies in the rough. Every instrument of his culture bears traces of its development from simple forms: the spear and knife-blade from the sharp-edged flint flake; the saw from the jagged-edged flake; the matchlock from the crossbow; the warrior's armour from the scaly hide of beasts; the plough from the stag's antlers or the tree-branch; the mill from pounding-stones; the ship from the scooped-out trunk; the oar from the hands or feet as primitive paddles; the house from the sun-baked clay hut, or, as in China, from the Tatar tent; the pyramid from the earth-mound or cairn; the alphabet from picture-writing; sculpture and painting from rude scratchings on bone and horn; stringed instruments from the twang of the hunter's bow; wind instruments from the blast of his horn; poetry and song from the rude but impassioned savage chant of love and war; arithmetic from primitive perception of more or less; counting and measuring, as shown in our words cubit, ell, foot, hand, digit, span, and in cognate terms from other languages, from using the fingers, toes, and other parts of the body; geometry, or *land*-measuring, from early perceptions of space; all science from crude and false guesses about the nature and causes of things, from illusions of alchemist and astrologer, which made attainment of the truth more possible to chemist and astronomer; and so on through the whole range of man's social and intellectual development.

* Cf. Fiske's "Outlines of Cosmic Philosophy," ii. 342–346.

† White's "Selborne." Letter xiv. to Mr. Barrington.

COAL.

By W. Mattieu Williams.

UNDERGROUND ventilation presents problems of great practical difficulty. A thorough searching and abundant flow of air through every main road, cross road, and by-way in a coalpit is a stern necessity, a matter of life and death. Not only the exhalations from the lungs and bodies of the men and horses, and the products of combustion of the lights have to be removed, but also the gases from the coal itself. These at times burst out in violent jets; some of them are inflammable, others suffocating, and all must be swept away.

If we should judge by the usual failure of our architects and builders to secure the steady and uniform ventilation of public and private buildings, the satisfactory ventilation of a coal mine would appear practically impossible. The air for the mine has to be all carried down artificially; in some cases to perpendicular depths of a quarter of a mile below the surface, and has to proceed in a complex, zigzag, winding journey, all round every side—north, south, east, west, and all intermediate points; down the middle and up again; through low-roofed passages extending to an aggregate length measurable in miles; and then it must climb up again, bearing with it all the pestiferous gases and vapours it has encountered in the course of its long journey.

As an illustration of this, I will repeat the figures I have already quoted when writing on "Domestic Ventilation" in an early number of Knowledge. They are from the Report of the Lords' Committee on Coal Mine Accidents in 1849. At the Hetton Colliery the quantity of air carried down amounted to 168,560 cubic feet per minute. Its rate of motion was 12 miles per hour. The main current was cut into 16 splits or subdivisions of about 11,000 cubic feet per minute each, and having on an average a course of

$4\frac{1}{4}$ miles each. The greatest length of a single course was $9\frac{1}{10}$ miles. The total distance travelled was 70 miles. All these quantities are now greatly increased in the larger mines of the present day. As much as 300,000 cubic feet per minute is in some cases supplied.

Much ingenuity has been expended on the invention of huge air-pumps and fans for the ventilation of coal mines. Many have been patented, and a few actually used, rather in small continental mines than in the larger collieries of this country. The steam-jet has also been applied. But the most successful agent, the giant whose services can be obtained at the smallest wage, is gravitation. The bunglers of domestic ventilation seem to forget, or not to have learned, that air is heavy, and becomes of itself a directly available ventilating engine by its accommodating variation of weight in proportion to bulk. The simple principle upon which colliery ventilation is conducted, and other ventilation should be conducted, may be illustrated by the following experiment.

Place a few layers of paper on a table, and on this a lamp-chimney—the use of the paper is to afford a cushion on which the bottom of the chimney shall rest without air space between it and the table. Then take a candle-end about an inch long, light it, and place it on the paper with the chimney over it. In spite of the open top of the chimney, the candle will be suffocated for lack of air—will flicker and struggle, and finally become extinguished by its own exhalations if the chimney is above six or eight inches high and the candle is placed fairly in the middle of the chimney. Repeat this more than once to prove that the extinction is not accidental.

Now cut a piece of metal (card will do if slightly moistened and carefully used) of T shape, with the stem of the T nearly as wide and long as the lamp-chimney, and the cross top just sufficient to serve as a rest, so that the broad stem may hang down and divide the tube into two equal partitions, extending from the candle-wick upwards. Now relight the candle and place the glass chimney thus divided into two partitions over the candle as before. The flame will presently take itself to one side or other of the dividing partition, and, having once done so, will remain on that side and burn freely, though occupying an apartment with only half the air space of that in which it was previously smothered.

If the experimenter is one of those wicked people who smoke tobacco, a puff from his pipe or cigar directed to the top of the divided chimney will demonstrate at once the reason of the change. The smoke will be forcibly dragged down that side on which the flame of the candle is not, will turn rapidly round the lower edge of the partition, and then rapidly ascend on the side in which the flame of the candle is.

The *rationale* of this is simple enough. When the chimney is divided by the partition and without the candle flame, there are two columns of air communicating below, one on each side of the partition. So long as these are of equal temperature, and consequently of equal weight, they balance each other and remain at rest; but when the candle is lighted and its flame takes to one side or the other, that side is heated and expanded. There is less air in a given space on that than on the other side, and consequently the heavier column presses up the lighter, which thus ascends by virtue of the impulse given to it by the preponderating gravitation of the cooler air in the other partition.

When the chimney is undivided the candle-flame raises all the air within it to a higher temperature than the outer air, and therefore this denser outer air proceeds to sink below the lighter air; but in doing so it encounters the uprising heated air. A struggle ensues between the directly opposed currents in the confined space. The flame of the candle indicates this very instructively. It has sunk down nearly to extinction, when presently it starts up vigorously, being blown aside at the same moment. This is when its feeble heating power permitted a downcast of fresh air on one side or other, but the greater this downcast, the greater the uprising and consequent resistance to fresh downcast, and thus, after a series of near approaches to death and sudden revivals, the flame at last expires.

The lamp chimney in this experiment represents the shaft of a coalpit divided as coalpit shafts formerly were divided in this country by a brattice, and as they are still divided in other countries where human life is held less sacred than capital. I have already referred to the accident which was mainly instrumental in bringing about this legislation, but an interesting letter I have received from a reader of Knowledge (who writes from Hetton-le-Hole, and evidently understands what he is writing about) tells me that I made a mistake in attributing the wreck of the brattice to a swing of the cage. As the catastrophe is historical and instructive, and my mistake was derived from a published account that must mislead others, I will quote the letter. Mr. Moon (or Moor) says: "The real cause of the melancholy accident (which took place on January 16, 1862, causing the loss of 202 lives) was the fracture of the cast-iron beam of the pumping-engine, and the consequent precipitation of its outer end (weighing about twenty-two tons) down the pit shaft. It carried away the wooden brattice, pumps, and the pit work generally, and blocked up the shaft to a depth of about 138 yards from the surface, where the downward course of the *débris* was arrested by the oak buntons on which the middle set of pumps rested. Every effort was of course made to rescue the imprisoned men, but it was found impossible, so great was the wreck, to clear the shaft in time, and the result was that the whole of them succumbed to suffocation by the carbonic acid gas."

The death of these poor fellows by suffocation in spite of the large space of main roads, cross roads, and workings, demonstrates the absolute necessity of continuous and sweeping ventilation. This disaster further proves the terrible risk to which the whole population of a colliery is exposed wherever there is but one shaft—one outlet. Any accident whatever, and there are many that may occur, which closes this one outlet or damages its hauling and ventilating machinery, leaves them imprisoned in a dreadful tomb, in a position to which no demands of trade or commerce or other men's luxury should wilfully render them liable. Therefore our legislature justly ordered that thenceforth no colliery shall be worked with less than two shafts, so that if one should be disabled, the other remains available for escape.

A second shaft being now compulsory, neither is bratticed, and one is used for the descending, the other for ascending current, or, in technical language, one is a downcast, the other an upcast shaft.

In some cases it is possible to obtain a natural downcast and a natural upcast without any artificial aid. This best occurs when the dip or slope of the coal-seam is in the contrary direction to that of the surface slope. It is possible whenever they differ, but the greater the difference the better. Let us suppose that the coal-seam is level and the surface sloping, the required difference is obtainable by sinking two shafts down to the coal—one where the coal is nearest to the surface, and the other where it is much deeper. Thus we should have two shafts of unequal depths, and consequently bearing columns of air of unequal heights.

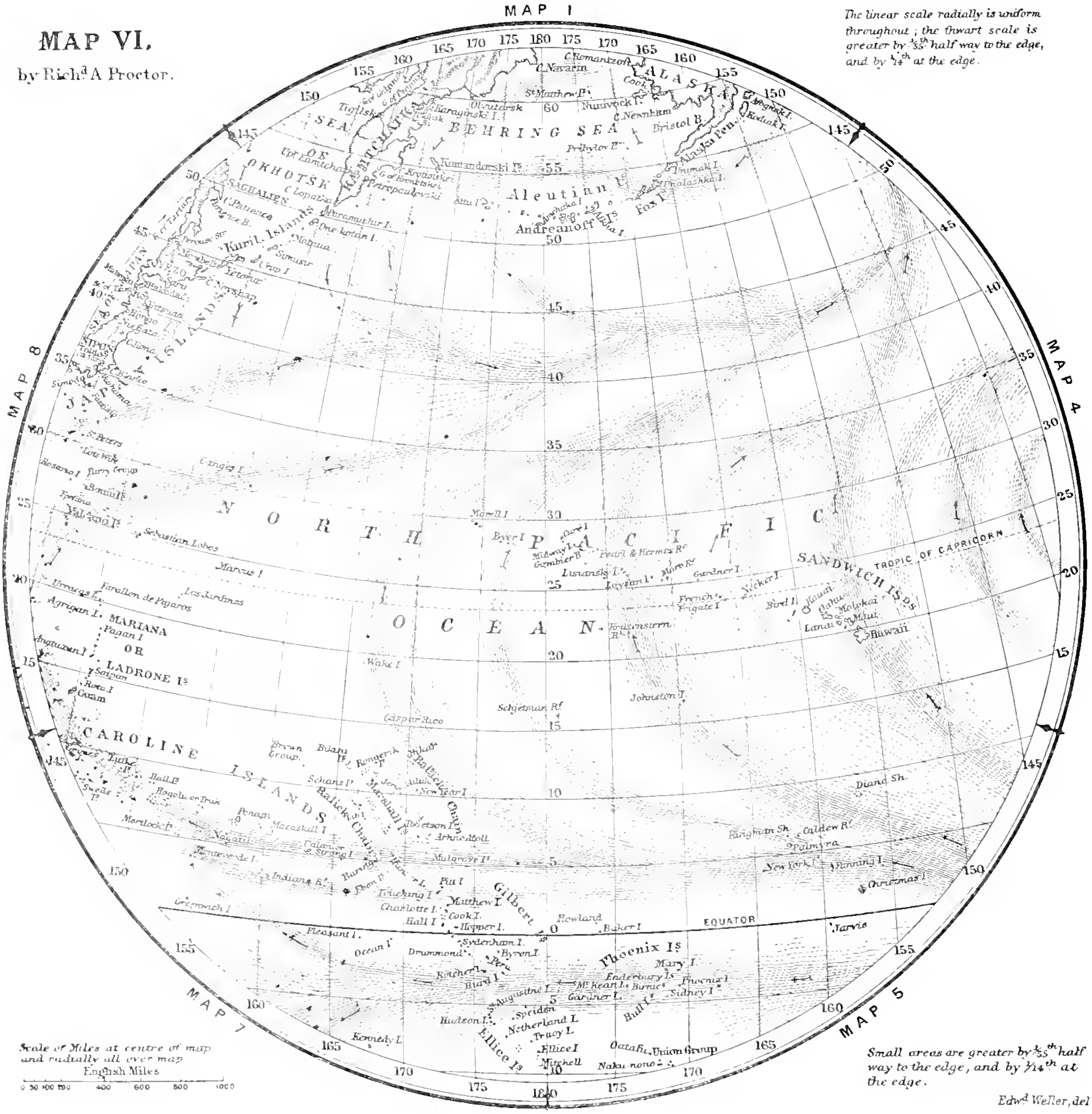
In workings of moderate depth the underground temperature remains all the year round at the mean temperature of the air above; at greater depths it increases about 1° to 60 or 70 feet. In the first case the air of the pit will be cooler in the summer and warmer in the winter than the air above. Let us suppose, for example, that the depth of one shaft from the surface is 600 feet and that of the other 100 feet. Both shafts convey to the workings below the general pressure of the great atmospheric ocean. But the column in the deeper shaft is made up of 600 feet of underground air supplemented by the outer air, while the shallower pit has but 100 feet of underground air, and makes up the equivalent 600 by 500 more of outer air.

Therefore, if the outer air is denser than the underground air (as in winter time), the pressure in the 100-feet shaft will preponderate, and *vice versâ* in the summer, when at a given level the column of air pressing through the deeper shaft includes 500 feet of denser underground air in the place of 500 feet of warmer outer air that is pressing through the 100-feet shaft. For reasons presently to be explained, such automatic ventilation is but little used in coalpits.

THE ONE-SCALE ATLAS.

MAP VI,
by Richd A Proctor.

The linear scale radially is uniform throughout; the thwart scale is greater by 1/35th half way to the edge, and by 1/14th at the edge.



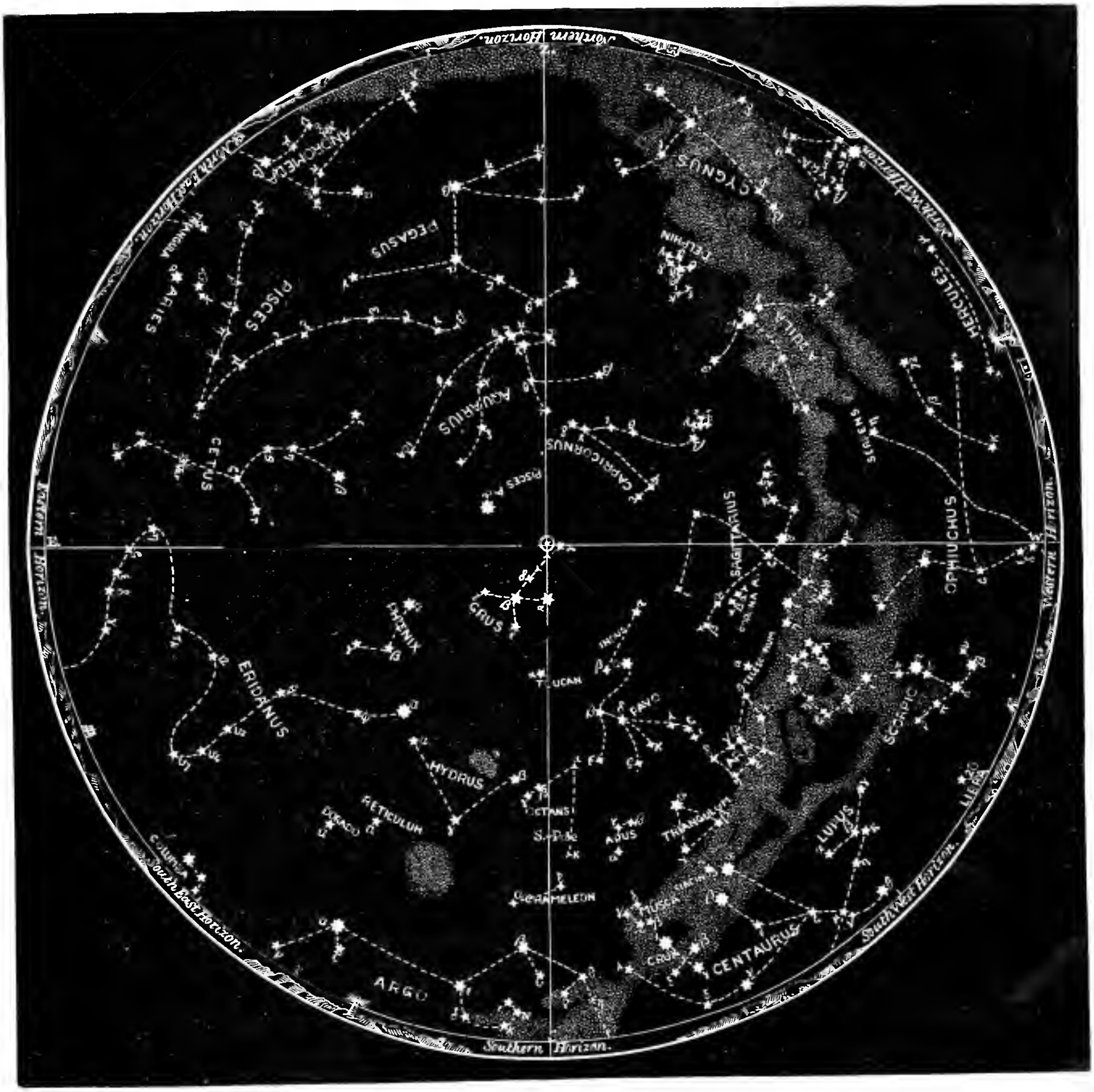
Scale of Miles at centre of map and radially all over map
English Miles
0 50 100 150 200 400 600 800 1000

Small areas are greater by 1/35th half way to the edge, and by 1/14th at the edge.

Edwd Weller, del

THE SOUTHERN SKIES.

MAP X.—For JULY, AUGUST, and SEPTEMBER.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 46° TO 24° S.)
AND THE
SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, Aug. 7.
,, 12.30 ,, ,, Aug. 14.
,, Midnight, Aug. 22.
,, 11.30 o'clock, night, Aug. 29.

At 11 o'clock, night, Sept. 6.
,, 10.30 ,, ,, Sept. 14.
,, 10 ,, ,, Sept. 21.
,, 9.30 ,, ,, Sept. 29.

At 9 o'clock, night, Oct. 7.
,, 8.30 ,, ,, Oct. 15.
,, 8 ,, ,, Oct. 22.
,, 7.30 ,, ,, Oct. 30.

STAR MAGNITUDES

First . . . ✸ Second . . . . ✶ Third . . . . ★ Fourth . . . ✦ Fifth . . . ▲

IMPROVING SHAKESPEARE.

By Benvolio.

I WAS a very small boy when I made my first emendation on Shakespeare, and, though it was quite wrong, I think it was not much more faulty than some of those which the learned Bentley made on Milton's text, and which the most profound Shakespeareans have ventured on the text of Shakespeare. My emendation was made on the text of "Twelfth Night." A passage in that most charming comedy perplexed my young mind, viz., where Ophelia says, "Rudesby, begone!" I wondered who Rudesby was. Might it not be Fabian's other name? But the list of *dramatis personæ* said simply Fabian. Then the idea presented itself that Shakespeare had probably written "Rude spy, begone!" This made everything clear. Olivia is still addressing Sir Toby. She has already told him to be off, as "fit only for the mountains and the barbarous caves, where manners ne'er were preached;" but manifestly he has lingered, so she turns from Cesario (*i.e.* Sebastian), and, seeing Sir Toby still contemplating them, calls her kinsman very naturally a rude spy.

It were to be wished that all Shakespearean emendations were as natural and as little forced. The change of one letter is slight compared with some of the changes they have asked for. Even when "a table of green fields" was altered into "a' babbled of green fields," beautiful though this emendation undoubtedly was, a certain daring was shown.

My emendation was quite wrong, however, though I held to it for many years. The real interpretation of the line is curious. The word "rudesby" is still in use in the part of England where Shakespeare was born. I cannot say I have heard it myself, but, talking a few years ago with Mr. Christie Murray, who is a Warwickshire man, I learnt from him that the expression is quite commonly used in Shakespeare's county for a lout, a coarse, rude fellow. How widely the use of the expression extended in Shakespeare's time, I do not know; but quite probably the word was as distinctly provincial in his day as now, though he may not have suspected it.

I have learnt since those early Shakespearean days of mine to look with much doubt on attempts to remove difficulties in Shakespeare's plays by verbal, or even by literal changes—at least until a very resolute effort has been made to find an interpretation for the words as they stand. The edition of Shakespeare I read when nine years old certainly encouraged attempts at verbal and literal emendation. The plays came out in penny numbers—not so cheap as the wonderful ninepenny (nominally shilling) Shakespeares now obtainable in England, but in those days a daring experiment. The penny plays did not exactly form an *édition de luxe*. How well I remember the varied tints of the paper covers! I had a notion that in some way they indicated the nature of the play, till a re-issue abruptly shook my faith by offering "Othello" in the lilac-tinted cover which I had thought appropriate (goodness knows why!) for the "Taming of a Shrew"; while "A Comedy of Errors" appeared in the dark blue cover in which the anguish of the "Moor of Venice" had been before enwrapped. The text was not by any means pure. I remember that I learnt the part of Aufidius for parlour recitation, my elder brother being Coriolanus (awful nuisances we must both have been, I imagine), and I brought the house down (very likely they were only waiting a decent excuse for laughing) by denouncing the fraternal Coriolanus as "insolvent villain!"—so my text, however, had it. Only five lines before, the Second Lord, represented for the occasion by a sister, had perplexed the auditors by remarking, equally with the authority of our penny Shakespeare, that Coriolanus "is noble, and his fame folds in this orb: O the earth"—a statement which I imagine no one on "this orb o' the earth" could interpret as our Second Lord announced it.

The emendation mentioned above, by which Mrs. Quickly is made to say that Falstaff's "nose was as sharp as a pen, and a' babbled of green fields," has justly been regarded as very happy, yet (perhaps because I am prejudiced against such emendations) I doubt if Shakespeare ever wrote that. Somehow that heavy spondaic ending "green fields" sounds unlike Shakespeare, at least in such a poetic passage. Then, is not the touch too fine for such a woman as Mrs. Quickly? Shakespeare might have put such a saying in the mouth of a Kent talking of Lear's last thoughts. He might even have pictured a worthier person than Mrs. Quickly recalling such thoughts of the dying Falstaff, unlike though they were to anything he had spoken about while before us in the fulness of his jolly wickedness; for many a man of similar life has wandered back in that way in his dying moments to his boyhood's purer thoughts. But if Falstaff had had such thoughts old Quickly would not have talked of them. She recalled his remark that "women were devils incarnate" with the appropriate explanation (for her) that "a' could never abide carnation; 'twas a colour he never liked," and, moreover, that "he was rheumatic" (a line in "Venus and Adonis" shows we must accent the first syllable), and so knew not what he was saying. But nowhere does Mrs. Quickly say anything to match with the tender thought, "he babbled of green fields." She would have put such thoughts from him, and afterwards from her own mind, just as when he called on God she told him, "To comfort him, a' should not think of God; there was no need to trouble himself with any such thoughts yet." [Here, by the way, seems further reason for thinking that he had not begun to babble.] In the folio, which contains the first complete edition of the play ("Henry V."), we have the apparently unintelligible words, "His nose was as sharp as a pen, and a table of greene fields." It has been suggested that the true reading is "on a table of greene frieze," but the frieze is objectionable. Why not simply "on a table of greene fields"? The word "field" for a blank coloured space, was in much more common use formerly than now. The reader will remember the Black Knight's shield in "Ivanhoe," bearing a shacklebolt on an azure field; and it is known that heraldic terms were once in very common use. The emendator who suggested "on" for "and" said, very justly, that it would be quite in Mrs. Quickly's way, having been reminded of a pen as sharp-looking, to recall the occasion when the pen had been seen by her which suggested the comparison, the greenish table, perhaps, being called to her recollection by Falstaff's pallor. Her remark would then simply mean, his nose looked as sharp as a pen such as I once saw lying on a table of green field-tints—that is, of green background.

That this would be in Mrs. Quickly's manner, and, therefore, more Shakespearean than the other reading, though not so poetical, cannot be doubted. Consider the way in which, whenever she tells of anything, she runs off into all sorts of side-recollections; as, for example, "Marry, thou didst swear to me upon a parcel-gilt goblet—sitting in my dolphin chamber—at the round table—by a sea-coal fire—upon Wednesday in Whitsun week—when the Prince broke thy head for liking his father to a singing man of Windsor." And, again, "Did not Goodwife Keech, the butcher's wife, come in then and call me gossip Quickly? coming in to borrow a mess of vinegar—telling us she had a good dish of prawns—whereby thou didst desire to eat some—whereby I told thee they were ill for a green wound."

So wandering is Dame Quickly's mind, indeed, and so clearly has Shakespeare already shown this, that I am not sure we need even change a word. From her such a saying as "his nose was as sharp as a pen, and a table of green fields," would be intelligible, though not from any person of coherent ideas; if this is not admitted, and we change "and" to "on," it may be said the change is as great as from "table" to "babbled"; but the former mistake is one which a compositor would be much more likely to make than the other. No one would ever think of altering "a' babbled of green fields" into "a table of green fields" if he had read the words aright; whereas it would be a commonplace and familiar sort of mistake to set up "and" for "on." As regards reading the passage right, it should be remembered that Shakespeare would have written the word "table" with a capital "T," but "babbled" with a small "b." (The double "b" does not count, I must admit, for "babble" was written "bable" in Shakespeare's time.

On the whole, however, the strongest objection against the poetical "babbling of green fields" is that it is far too poetical for Mrs. Quickly, it was wholly beyond her nature to have described Falstaff's wanderings so touchingly.*

And here I may notice what I take to be a wholly faulty objection taken by many, and in particular by Charles Reade (in "Hard Cash"), to the familiar simile in the best known of Hamlet's soliloquies, where the Prince speaks of taking up "arms against a sea of troubles." What arms? asks Reade; "I suppose buoys and a cork jacket," or words to that effect. It does not seem to be noticed when such objections are made that it is Hamlet, not Shakespeare, who is soliloquising. Hamlet may not be mad, though I myself cannot see how the theory of his being wholly sane can be maintained by any one who notes that it was immediately after he had seen the Ghost, and long before he could have formed any deliberate plan of simulating madness, that his wild and whirling words are first heard; but he is assuredly much perturbed in spirit. Apart from this, though we call the passage a soliloquy, and though it is always delivered as such, Ophelia is present all the time. If Hamlet's madness is wholly assumed, yet the assumption would not be thrown off here; and as a matter of fact Ophelia throughout the scene deems Hamlet mad, saying the moment he leaves, "O what a noble mind is here o'erthrown!" Now, for Shakespeare, composing a sonnet, to speak of "taking arms against a sea of troubles" would doubtless be false poetry; but for the much-perturbed Hamlet, in the presence of one whom he would have regard him mad, to speak in that way would be altogether a true dramatic rendering of the position. The words would not even be utterly "wild and whirling"; they would only wander enough from exactness to correspond with Hamlet's state of mind, actual as well as in part assumed.

There is a passage in the same play which has exercised commentators, and led to the invention of multitudinous new readings, though it needs in reality no change whatever, and if a little confused or rather, I should say, complicated, can yet be quite readily and reasonably interpreted. Osric has just, in elaborate phrase, praised Laertes—so elaborately that Horatio presently asks whether they might not as well speak in "another tongue." But before saying this Hamlet mimics the idiotic phrases of Osric, in the remarkable answer beginning, "Sir, his definement suffers no perdition in you; though, I know, to divide him inventorially would dizzy the arithmetic of memory; and yet but yaw neither, in respect of his quick sail." (This exquisite fooling is not in the folio, the Hamlet in which was edited from a playhouse transcript.) Does not some dullard, whose arithmetic of reason must have been grievously dizzied, propose the substitution of "raw" for "yaw"?—turning complication into sheer nonsense. Repeatedly one sees this passage quoted as manifestly corrupt, and sometimes as hopelessly corrupt. Many alterations have been suggested, though I think nothing quite so idiotic as "raw" for "yaw" has ever been proposed. In reality no change is necessary. Osric has been mixing up his ideas and his metaphors in the most preposterous fashion; Hamlet, therefore, does the like. Definement, perdition, inventory, dizzying, arithmetic, and memory—surely after mixing these in the compass of three lines he may be expected to start yet another idea in the rest of the sentence. The "quick sail" shows that he has done so; and the sea term "yawing" belongs to this new idea. It may not be so familiar in our mouths to-day as it was in men's mouths in Shakespeare's time, when all men talked of the doings of the sea-dogs who made Elizabeth's days famous for all time. Many an English buccaneer had seen the big Spaniard that sailed in pursuit "yaw" as he punished her about the bows with ball and bullet—not wholly giving up the chase, but leaving her course as his blows fell on her cumbrous prow and forecastle. (For only a steady crew can steer a ship truly under such conditions.) Such a man, describing the chase afterward—very likely Shakespeare had heard many a yarn of the kind—would tell how the pursuing ship crowded all sail, and came on in swift pursuit, "yet but yaw as we pounded her bows, and so fell astern in respect of our quick sail." That is just what Hamlet, mixing his metaphors, means. "Sir," he says, "he suffers no loss as you define him; though I know to set out all his qualities as in an inventory would grievously tax the memory, and even then fall behind, so far ahead of all praise do his abilities take him."

The curious passage about knighthood in the "Merry Wives of Windsor" is another of those which seems to me to have been needlessly dealt with as difficult. Mrs. Ford has said she "could be knighted" (playing on the words); Mrs. Page pretends to understand her to mean that she might herself be made a knight, and answers, "What? thou liest" (mid-county English for "you lie under a mistake"). "Sir Alice Ford! these knights will hack; and so thou shouldst not alter the article of thy gentry." A commentator says the word "hack" refers to hacking off a knight's spurs in token of disknighting. This is nonsense; Shakespeare had no such meaning. Mrs. Page would hardly have suggested that a woman knight would be received by other knights with contumely, and rejected from their order. The word "hack" is used in its other sense, quite familiar in Shakespeare's time, the sense of growing common. She says, in fact, these knights will soon be so common that a simple gentleman will have better standing; so keep you to your gentry, not going in for knighthood. (Shakespeare uses the word "hackney" in "Love's Labour's Lost," and "hackneyed" in the first part of "King Henry IV.")

A passage which has given rise to much dispute is that

* It is absolutely certain that the passage should not be left and understood precisely as it stands in the folio. Remembering that Shakespeare repeatedly uses "table" or "tablet," or any small surface on which marks or colouring may be put, while in his time a patch of colour was called a field, may we not understand the words, "his nose was as sharp as a pen, and a table of greene fields" to mean simply, "his nose was as sharp as a pen, and a mere tablet of green spots"? In other words, having given her unpoetical account of the shape of Falstaff's nose, Mrs. Quickly adds an equally ridiculous description of its colour. Shakespeare represents Falstaff as dying of a sweat—that is, of the sweating sickness—and in that disease no such changes of colour took place. Bacon expressly says there were neither purple nor livid spots. But this was probably not known to Shakespeare, as the sweating sickness died out finally in 1551.

in which Lenox, speaking of Macbeth's attempt to fix Duncan's murder on the princes, Duncan's sons, says:—

> Who cannot want the thought how monstrous
> It was for Malcolm and for Donalbain
> To kill their gracious father?

This, say the commentators, should clearly have been, "Who can want the thought?" and a score or so of suggested changes have been proffered. In reality it seems clear Shakespeare wrote the passage just as it stands. Nor does the simple meaning of the words seem unnatural or farfetched. "Who is there" so unapt to think justly that he cannot (that as it were, he is not *canny* enough to) wish to entertain the thought that it was most monstrous for the princes to kill their father, though we as courtiers *must* not think in that way. Of course, this way of speaking is a trifle strange, but then the whole of Lenox's speech is strangely toned. "'Twould have angered any heart alive to hear the men deny 't," he says of the grooms, whom Macbeth accused of the murder and killed—a quaint way of indicating his own opinion that Macbeth murdered them that they might have no chance of denying the charge, and so throwing the guilt on him.

THE "SATURDAY REVIEW" ON LUCK.

By Richard A. Proctor.

"We" have the receipt of fern-seed; "we" walk invisible;—as in a castle "cocksure."—Shakespeare.

THE *Saturday Review* informs me that my little book, "Chance and Luck," does all that I hoped it would do, all that I wanted; nor do I feel intense sorrow when I learn from the same infallible source that my book fails to achieve a result which no man in his senses would ever hope to accomplish. I strove to show those who are not wholly foolish the folly of gambling and speculation by presenting, as a matter of simple evidence, the risks to which they expose themselves, and this, the *Saturday Review* condescends to tell me, I have done satisfactorily. "Mr. Proctor is valuable in his handling of 'martingales,' in his refutation of the incalculably mischievous doctrine of the 'maturity of the chances'; in one particular point Mr. Proctor comes out in a way that if not novel is certainly not common"; moreover, "some of his demonstrations, such as that of the danger of certain popular kinds of Stock Exchange gambling and the like, are decidedly useful."

But, *surgit amari aliquid*, in a *Saturday Review* critique, "Certain old fallacies of the mathematical expostulator with those who gamble" are "as rife as ever in Mr. Proctor's work"; perhaps even "they are more rife than ever, owing to Mr. Proctor's well-known 'cocksureness,' and his constitutional inability to conceive that any one who differs with (*sic*) him can possibly be right."

In passing, though far from me be the presumption of imagining that a *Saturday Reviewer* can possibly be mistaken, I have been so much in the habit of doubting my own conclusions—so careful in lectures, essays, and books to suggest caution and introduce again and again expressions of doubt—that I rather wonder how I come to be well known for "cocksureness." I know the Hampdens and Parallaxes, against whom I have had to maintain the cocksureness of certain scientific theories which are *not* mine, think me "cocksure" to a degree. But I doubt if even a *Saturday Reviewer*, in one of his most rampant moods, could point to a case in which I have been "cocksure" about anything not admitting of mathematical demonstration—like the Copernican theory on the larger scale and the solar theory of the corona, or the selections of stations for observing Venus transits, on the smaller. A reviewer, however, who expostulates with all "mathematical expostulators," and that, too, about matters purely mathematical, ought to know a good deal about cocksureness.* Indeed, one would be disposed to exclaim just here, were not the quotation somewhat musty, *Quis tulerit Gracchos de seditione querentes?* If a *Saturday Review* critic can be capped for cocksureness, where in creation is the cocksure customer who can cap him?

This, however, is a digression.

The modest reviewer goes on to remark that, like all the mathematicians whom he ever knew to discourse on chance and luck, "Mr. Proctor appears to be under a delusion as to the actual meaning of the notion—the superstition, if he likes—of luck." (Of course it is not conceivable that all the mathematicians may be right, and the *Saturday Review* mistaken, about this notion or superstition.) Where I and all the mathematicians have gone wrong, it appears, is in overlooking the fact that the man who buys a ticket in a lottery, or wagers money on a horserace, does it because he has a chance of getting a large sum by risking a small one, and is not troubled by the circumstance that he has to pay more than the true mathematical value of his chance. "Stranger," said a western farmer to a man who reasoned with his son about the folly of intemperance, "your argeyments air all right, and I ain't no fault to find with the way you put 'em, ef you was a reasoning with any one else; where you slip up is, you ain't nary a notion what a dog-goned fool you're a talking to." That farmer, though, probably knew his son better than the temperance man did; whereas I think I show in my book a tolerably clear appreciation of the folly of gamblers. Again and again I dwell on the very point on which the *Saturday Review* insists, rightly enough, except in pretending to correct me about it. The demoralisation on which I dwell so persistently throughout my book is most clearly shown by the very circumstance that men bite so blindly when offered a chance of a large prize for a small sum risked. "Gambling," says the *Saturday Review*, "is justified of her children," because the chances of growing rich are not offered them at mathematical odds, though if they were plentiful at those odds "Mr. Proctor would be right in denouncing the folly of those who take them at other" odds. But, as a matter of fact, I have not denounced the folly of those who take chances at unfair odds, but the iniquity of those who offer them; and I have urged as the chief reason of my denunciation that, in so doing, the rascals take advantage of that very weakness which the *Saturday Review* says I overlook.

Mr. Richard Babley, better known as "Mr. Dick," when asked to explain a certain piece of folly, said he supposed it was done "for pleasure." The *Saturday Review* explains with equal simplicity that gamblers play their foolish tricks for profit. But Mr. Dick was a little crazed; a *Saturday Review* critic should know better.

My critic says "in vain" do mathematicians show that in a series of mathematically equal chances some must repeatedly win largely and others as repeatedly lose. A man might accept this, it seems, and yet be a firm believer in luck and a confirmed gambler. Of course he might; there is no limit to the possible inconsistencies and incongruities of gambling. Yet even such a fool as my critic imagines

* If I repeat this hateful word it is perhaps chiefly because the *Saturday Review* attributes to me "crudity of phrase," and I want to show how curiously crude is my critic's own phraseology. It is a compliment to be corrected for crudity of phrase by a writer of so strange a taste in such matters.

would hardly reason (save the mark!) as this particular fool is supposed to do. "I say that some, perhaps not all, of these men will be lucky men. I can't prove it. You can't disprove it. My belief and your demonstration are in different planes, and don't touch each other." Mr. Dick could hardly beat this "mystical order of thought," as my critic very properly calls his nonsense. How can such a matter be better dealt with, if mathematical reasoning is rejected, than by actual trial? The test *has* been applied in multitudes of cases, and always with results confirming the mathematical theory of the matter. Yet for the general public there is, perhaps, no better answer to the *Saturday Reviewer's* suggestion that there are not only men who have been lucky (as I point out), but men whose luck is something which may be depended on (which is what I and all mathematicians deny), than the well-known fact that not one of the gambling and speculating herd who have been noted as examples of long-continued luck has failed to come to grief in the long run. I exclude, *bien entendu*, those who have been called lucky, but have in reality been simply rascals. They often grasp their ill-gotten gains to the bitter end.

With characteristic impertinence the *Saturday Review*, in beginning to comment upon the morality of gambling, speaks of that as ground into which, as it is not mine, I had no business to venture. I should like to know why this ground is not as much mine as it is any one else's? Can those who glibly quote, "*Ne sutor ultra crepidam*" give any reason for saying that one man has a better right than another to deal with moral questions?—always excepting criminals, and perhaps certain classes of critics. Questions of morality are fair subjects for all honest men to deal with, and I have yet to learn that the study of science is calculated to warp a man's moral nature so that he would be apt to decide wrongly about moral questions. So far as my critic's arguments are concerned, however, they may be disposed of by the simple admission that they would be just enough if I had maintained gambling to be criminal, instead of merely suggesting that it is immoral. The reviewer does not seem to understand what is meant by morality. (For example, it is immoral, but not criminal, to pervert the truth.) That he sneers, however, at Mr. Herbert Spencer, while he jeers at my views about the morality of gambling, would tend considerably to console me if I needed consolation, which, somehow, I scarcely seem to do.

My critic honestly thinks, I dare say, that he has me on the horns of the whist dilemma he offers me. If betting with superior knowledge is unfair, how about "Mr. Proctor's fondness for whist? Is not the superiorly knowing whist-player fraudulent?" And if the whist-player is honest who wins money through his superior skill, must not the bettor who offers or asks odds such as he knows to be incorrect be honest, too? I need not, so far as I am personally concerned, select either horn of the dilemma. For all my whist-playing for money, limited as it has been, has been against equal skill or, in my salad days, against skill superior to my own. When I argued, as my critic quotes, that "if inferior players choose to play on equal terms, they do it at their own risk," I was considering my own case when, rather than spoil a rubber, I have consented to play for sixpenny or even (!) shilling points, in a company unwilling to play for "love." Since I have learnt something of the strategy of the game I have only twice consented to play for even shilling points. On one occasion I met three of the strongest players of the Manhattan Club, New York, and on the other three players of the New Orleans, one of my opponents being Mr. Trist, the inventor of the American leads, so much admired by "Cavendish." (It may interest readers to know that I won about as much in one encounter as I lost in the other.) The only club I have ever cared to join played threepenny points and sixpence on the rubber, and I was present at barely one of their weekly meetings in ten. In all my journeys at sea, since I learnt something of the game, I have declined to play even for sixpenny points.*

Dealing with my critic's remaining comments, I need remark only that, while he does not think my book likely to do much good, he asserts the unlikelihood, nay, almost denies the possibility, that any book on chance can do much good unless written "by one prepared to admit to the full the existence of 'luck'"—a novel idea indeed!

Summing up his criticism as an example of the average *Saturday Review* style, I note that—

First, this critic lightly ascribes "cocksureness" to me, who have again and again expressed doubts about my own views, or have modified them as occasion suggested, while himself exhibiting cocksureness in such amazing degree as to reject the verdict of "all the mathematicians" who have ever dealt with the subject of probabilities—though this is a subject purely mathematical, and about which he himself manifestly knows nothing!

Secondly, he attributes crudity of phrase to me, though citing no instances; but he shows the value of his opinion on such points by using in short articles such crude phrases as "cocksureness," "mathematical expostulator," "superiorly knowing," "*ex hypothesi* uncircumventible," "aleatory pleasure" (for love of dicing), "cocksureness," &c., to say nothing of such sheer blunders as "differing with" for "differing from," "stark man" for "powerful reasoner," "valuable" for "effective," and the like.

Thirdly, while pretending to regret that probably my book will not keep many from gambling or protect many from dishonesty, the *Saturday Review* deliberately justifies the gambling spirit, and even encourages that more obvious immorality, the practice of wagering, speculating, and gambling generally, with superior knowledge of the probable event.

Fourthly, pretending to reason about right and wrong, my critic does not hesitate to attribute to me ideas (such, for instance, as my supposed wrong notions about the hopes actuating gamblers who trust in luck) which he must well know that I have not expressed, but the reverse.

Such, on the average, is *Saturday Review* criticism, unless a special aversion is to be wronged, as when Mr. Herbert Spencer is attacked, or its great political *bête noire* is to be insulted, or else some special friend is to be puffed, as when certain capital books for boys are foisted on the public as great works of imagination.

As to the ideas I have advanced in "Chance and Luck,"

* I have taken considerable interest in watching the progress of play with a very keen opponent—an excellent player of his own hand—in order that I might recognise how far the effects of chance (often very marked in an evening's or even in a week's play) are corrected in the long run. My wife and I (she is the best player of her sex I have ever known) have played since I began to keep a record of results about 3,500 points against the opponent in question, he taking three partners at different times, one of whom is that trustworthy partner, Mr. Single-dummy. Combining the results, we are just over 400 points ahead, his best average being obtained with Single-dummy as partner, where he is 155 points behind on a total of 1,547 made. It should be noticed that we play for tricks only, not counting either honours or rubbers. This, of course, gives a much greater advantage to combined play than when honours, and the chances connected with the rubber tend to equalise matters. Still, we should not be so far ahead on the single-dummy play were it not for an inveterate habit our opponent has of visibly rejoicing over a good hand and as visibly sorrowing over a bad one. Nothing but such records as I have recently kept would have shown me how very importantly such indications affect results.

even the narrowest (unless it be considered the broadest) of my views, the real immorality of gambling, the experience of all civilised nations that gambling whenever encouraged has proved demoralising, and has had to be checked, affords tolerably good proof that there is something immoral in its very nature; for that must surely be tinged with immorality, which, when left to itself, proves invariably demoralising. But I repeat that I have not hoped, and cannot reasonably hope, that my book will correct the folly of the many. The wise never gamble or speculate (outside such speculation as every business or pursuit in life necessarily involves. The foolish will continue to gamble, probably, till the world's end. (A daring "joker of jokes" once said that such men would wager on the tone of Gabriel's last trump.) But, as I say in my preface, I hope that some may be influenced for good; a few who are between the wiser and the more foolish may join the better section if they are shown the unwisdom and immorality of gambling ways.

NOTES ON AMERICANISMS.

By Richard A. Proctor.

Gad. This old word for a spike or pointed instrument—akin to "goad"—is gravely given by Bartlett as an Americanism still "used in the North of England." It is still used in English dictionaries, and has been used from the days of Johnson, through Walker's time, onwards until now.

Gall. (1) This word, which, though used in England for bitterness of mind, has yet a peculiar American use for something between cool impudence and malignity, is not mentioned by Bartlett. The commonness of this usage is decidedly American. "You show gall enough," a rude man in America will say to his mother-in-law, sometimes even to his wife; where an Englishman equally wanting in politeness might say, "I like your cheek!" or use some similar vulgarism. (2) "A soil of vegetable fibres," says Vignoles, "matted and treacherous to the foot, unpleasant as well as dangerous to crop."

Gallinipper. A large gnat common in the Southern States, somewhat resembling the mosquito in proclivities and in appearance, but larger.

Gallivant. Because this good old English word is used in America precisely as it has been used from time immemorial in England it is included by Bartlett among Americanisms. The same remark applies just here to "galloping" (consumption); to "gallows" (for fine, adjectively or adverbially, this costermonger slang being gravely described as a New York expression); to "gallowses," for trouser-braces, or "suspenders," as Americans call them; to "galoshes," for overshoes, given as "a term universal in Canada"; to "gambree," for a hipped roof; to "gap" (used for openings made in mountain regions by rivers, to openings in fences, &c.); and to a host of other words beginning with "g." Bartlett is in fact particularly weak in regard to the English use of words which he includes among Americanisms. It does not seem to me that the occasional or local use of certain words in England should prevent us from regarding their general and colloquial use on the other side of the Atlantic as bringing them into the rank of Americanisms. But if words as commonly used in some special sense in England as in America are to be classed among Americanisms, I can see no reason why a full English dictionary should not be brought out as a dictionary of Americanisms.

Galoot. A common fellow, low-class person; the word does not seem always limited to the male sex. This word seems decidedly an Americanism. I should imagine that if found anywhere in the old country it would be in Scotland or on the border; for it seems to be of French origin, like the Scottish "galopin," an errand-boy, a common lad, and "gamin," a street-boy, young blackguard. But I know of no such word now in existence in the French language. Possibly someone acquainted with French argot can tell us of one. Everyone remembers how Colonel Hay's Jim Bludsoe, when he "saw his duty a dead sure thing," said—

> I'll hold her nozzle agin the bank
> Till the last *galoot's* ashore

(presumably including the female passengers). But in the following quotation from "Grandpa's Soliloquy"—a poem unknown to me, but I borrow here from Bartlett—the word seems restricted to the male sex, even as the words "galopin" and "gamin" have always been:—

> It wasn't so when I was young,
> We used plain language then;
> We didn't speak of them *galoots*
> When meaning boys and men.

Not knowing the context, I am unable to say whether the soliloquising grandfather here simply objects to the use of such ungrammatical slang as "them galoots," instead of saying "boys" or "men," or whether he objected to certain folks, properly called "galoots," being included when genuine boys and genuine men were spoken of. In the latter case the word "galoot" would seem to bear an unpleasant significance; in the former, and more probable, case (only, if that was meant, "them galoots" should have been put between *guillemets*) it would seem that the slang use of the term "galoot" is of comparatively recent origin.

Gam. A social visit: borrowed from seafaring terms. I cannot say I have ever heard the word used. But Browne's "Whaling Cruise" states that when two whalers meet in any of the whaling-grounds, it is usual to have a *gam*, or mutual visit, for the purpose of interchanging the latest news, &c.

Gander Party. A masculine social party. I once heard a lady in America speak of a club as a "gander gang," a term pleasingly alliterative if not strictly complimentary.

Gander-pulling. "A brutal species of amusement practised in *England*," Bartlett says, "as well as in Nova Scotia." I have never heard of "gander-pulling" being practised anywhere in Great Britain or Ireland, and must conclude therefore that Bartlett means New England. Cock-fighting is bad enough, but "gander-pulling," as described in "Sam Slick," and as more fully pictured in "The Prophet of the Smoky Mountains," is about the most disgustingly brutal form of sport it ever entered into the minds of men to invent. It must have been derived from the more barbarous among the Indian races. A goose is hung head downwards from a swinging rope on the branch of a tree, and a set of ruffians, riding under the suspended goose at a gallop, try to pull off the poor creature's head as they pass. I decline to degrade these pages by a fuller account of this disgusting and brutalising sport—no! scarcely brutalising, for no one could by any possibility be made more brutal than he must already be to engage in it.

Gar. A kind of pike found in Southern and Western rivers—sometimes called the alligator gar, perhaps because of the fact that it has been known to fight the alligator. Its business name is the *Lepidosteus*, formerly the *Belone truncata*. It is interesting from its kinship with the ganoid scaled fishes plentiful during Palæozoic and Mesozoic ages—as the *Pholidophorus*, *Cheirolepis*, *Platysomus*, &c.

Garden. The use of this word in America is peculiar, though Bartlett (not knowing the English usage, in all probability) makes no mention of it. What we in England most commonly mean when we speak of a "garden," Americans call a "yard"—a term usually limited in England to inclosed spaces which are not planted with trees, shrubs, or flowers—and perhaps most generally understood to signify an inclosed space which is wholly or partially paved. For instance, a school playground would hardly be called a "yard" in England. The word "garden" in America is applied to what we would call a market garden either for vegetables or flowers. The word "orchard" is used much as with us.

It is hardly necessary to tell the philological reader that the words "garden," "yard," and "orchard" are closely akin—orchard, however, being a compound—*ort-yard* or *wort-yard*. The following series of words may be worth noticing—it includes, however, but a few of the words akin in divers languages to our "yard" and "garden":—

Eng. *Garden, garth, yard, or-chard.* (*Greensward* must not be confounded with these words, as if greens-ward; it is green-sward, "sward" being an old name for "skin" or "rind.")

Saxon. *Geard, ortgeard, wyrt-geard*; Old English, *gearth.*

Gothic. *Gards, aurti-gards.*

German. *Garten*; Low German, *garden.*

French. *Jardin*; Old French, *gardin.*

Danish. *Gaard, urtgaard*; Icelandic, *garthr.*

Latin. *Hortus.*

Greek. *Chortos.*

The same root is found in *guard, guardian, gird, girdle, ward, warden*, and other kindred words. *Yard* the measure of length, *yard* in *yard-arm, goad, gad, hasta* (Lat.), and many other words, some of which have no apparent association with "guarding" or with *girding* or *girdling*, belong to the same family.

Query. What is the derivation of the name "Hard," used for a pier or landing-place for small boats?—as "Admiral's Hard," at Plymouth. This word does not appear in any English dictionaries I have, though it is in Webster. It may be akin to *yard*, as such landing-places are partly inclosed, or *girt* round. In a *dockyard* we see that a space so inclosed for ships is called a *yard*. Marryat uses the word *Hard* in "Peter Simple"; and it is quite commonly understood in the sense of a landing-place at such places as Plymouth, Portsmouth, &c. The word "hard" is also applied to fording-places where a river bottom is hard.

Garrison, for "Fort," seems to be a specially Western usage—continued long after a soldier has been in a place which was once a fort.

Gat or Gate, for a gap, is a usage borrowed from the old Dutch days. Washington Irving tells how from the old *Helle-gat*, or *Hell-gap*, there came *Hell-gate*, afterwards altered "by the mealy-mouthed to *Hurl*-gate, forsooth"! (Shakespeare has the "gate of hell," be it remarked in passing, and Milton speaks of the gates of that abode of the condemned, in giving his marvellously unscientific account of the transit of Satan from hell to earth—with gravity acting anyhow.)

Gather. Used in the West instead of "take up" or "pick up," and appropriately pronounced "gether."

Gaum (or Gorm). To smear. Still used in the eastern counties. "If Mrs. Gummidge didn't up with a bucket and lay it over that theer ship-carpenter's head," says Mr. Peggotty (or to that effect), "I'm gormed, and I can't say no fairer than that"—using the word for "smeared," as the word "darned" is used in divers parts of England and America, not as intended to suggest any real "darning" or "smearing," but simply as a good mouth-filling word, suggestive of that eternal condemnation of the wicked which has been so long considered an appropriate subject to swear by.

Gawnius. A gawk, *quasi lucus a non lucendo*; a "gawnius," because not a genius.

Gent. This word is used in two senses in America, one interesting, the other fearful; the interesting usage being apparently a true Americanism, the fearful one being common also in England.

1. *Gent*, for genteel, is interesting as being so exceedingly old. Said Chaucer five centuries ago:—

> Fair was this yonge wife, and therewithal
> As any weasel her body gent and small:

and now—or yesterday, at any rate (*circiter* 1704)—"Law you," we find in "Madam Knight's Journal," "it's right gent; it's awful pretty." The usage is French—*C'est bien gentil*, it's very pretty. Bartlett puts the word "gent," thus used, as equivalent to "genteel"; but though "genteel" might be thus used with propriety, it is seldom associated with the idea of prettiness. More often "genteel" is used for smallness, as "a genteel figure"; but this is not precisely the same as even Chaucer's usage in the above passage. For whereas "gent" with Chaucer means neatness and prettiness, "genteel" used of the figure implies not only that the figure is neat, but that in neatness there is what is understood by "gentility." A small figure is considered genteel, and therefore, though not quite logically, a genteel figure is understood to signify a small one. In Chaucer's time the French language had evidently adopted *gentil* as equivalent to neat and elegant. The Old English "gimp," from the Welsh "gwymp," may have suggested the monosyllabic form "gent."

2. "Gent" is used substantively as in England—a supposed abbreviation for "gentleman," really another name for the awfullest of awful cads. We shudder and pass on.

Gentiles, as used in Utah to distinguish from the Mormons those who are not Mormons, must now be regarded, I suppose, as an Americanism. When I lectured at Salt Lake City, I found myself spoken of in a Mormon paper as "a Gentile lecturer"—much as an æsthete calls an outsider a Philistine, or as a racing man speaks of a non-racing man as an outsider.

Gentleman. This word, like its companion word "lady," is so used in America that persons of respectability are relieved when they find themselves called "men" and "women." A negro boot-black is "a coloured gentleman." A respectable uncoloured person is "a white man"; and to be called "a white man" is to be spoken of with respect; to be called in America a "gentleman" is pretty nearly an insult. Whenever any one says to me, "Let me introduce this man to you," I know the chances are I shall be introduced to a good fellow; but when I hear the ominous words, "Here is a gentleman I should like to introduce to you," I know I am to make the acquaintance of a person engaged in politics or some kindred form of swindling.

In the East, however, they still try to keep up the old use of this word to distinguish a man of gentle breeding and good position from the uncultured. How successfully they do this may be inferred from those most hateful "gentlemen" who appear in Howells' novels, surely the greatest cads literature has yet produced, and from casual remarks in so-called "society" papers. An amusingly suggestive story appeared lately in one of these papers. A lady, described as "a leader of society in Washington," remarked that she knew X was not a gentleman, for she noticed that "he lifted his coat-tails as he sat down; a real *gentleman* never attends to such matters"—the fact being, I should have thought, that in such trifles a gentleman does as he pleases or as convenience may suggest, no real lady ever noticing, even though she may chance to have seen, what he does.

Gentleman Turkey. A turkey cock. A usage in the Western States much favoured by "nice persons," to whom Sidney Smith's definition of prudes as "nice persons with nasty ideas" is pre-eminently applicable.

WIND MYTHS.

By "Stella Occidens."

IN Russian folklore a being resembling Hulda in her worst aspect plays a prominent part. Her name, Baba Yaga, means a quarrelsome, scolding old woman; and she is for ever doing some spiteful or malevolent action. According to Ralston, her appearance is that of a "tall, gaunt hag, with dishevelled hair." Sometimes she is seen lying stretched out from one corner to the other of a miserable hut, through the ceiling of which passes her long iron nose. The roof of the hut is supported by "fowls' legs," and stands at the edge of a forest towards which its entrance looks. When certain words are spoken the hut revolves, and turns its back to the forest.*

Baba Yaga is sometimes represented under the appearance of the mistress of a house which stands in a courtyard inclosed by a fence made of dead men's bones. When she goes abroad "she rides in a mortar, which she urges on with a pestle, while she sweeps away the traces of her flight with a broom." She generally kills people in order to eat them, and out of their bones she makes the fence which surrounds her house. Their skulls are used as lanterns, in which she places flaring torches at night. A story is told of a young girl who once visited her, and was offered a piece of a human arm for her dinner. We are not told if she appreciated her meal; but it may have been so—there is no accounting for tastes.

One of the most interesting Russian folk-tales is that of Vasilissa the Fair. She had a cruel stepmother, who hated her because she was more beautiful than her own daughters. She treated Vasilissa very unkindly, and made her do all the hard work. However, Vasilissa always did all she had to do because she had a doll who helped her. At her father's death he left this to her, and said, "Keep it always by you, and never show it to anybody. Whenever misfortunes come upon you, give the doll food, and ask its advice. When it has fed, it will tell you a cure for your troubles." The doll always helped her when she did as her father told her, and she would carefully follow its advice. The stepmother went to live in a new house on the edge of the forest, in which Baba Yaga lived, and she would make every excuse to send Vasilissa on errands through the forest so that she might fall into Baba Yaga's power. One autumn evening, as the two sisters and Vasilissa were working, one of the sisters snuffed the candle and put it out. The stepmother had told her to do this, so that she might send Vasilissa to Baba Yaga's house to get a light. The sister, who was making lace, said:—

"My pins give me light enough; I shall not go."

And the other sister, who was knitting, said her knitting-needles gave her light enough, and she would not go.

"Vasilissa, you must go for the light," they both cried out together: "be off to the Baba Yaga!" and they pushed her out of the room.

Vasilissa went to her room, and taking her doll, she gave it a good supper, and asked its advice.

When the doll had eaten a good meal its "eyes began to glow like a couple of candles."

"Never fear, Vasilissa dear!" it said. "Go where you're sent. Only take care to keep me always by you. As long as I'm with you, no harm will come to you at the Baba Yaga's."

So Vasilissa dressed herself, put the doll in her pocket, and started on her walk through the forest. As she walked a horseman galloped by. He was dressed in white, and rode a white horse, and the day began to break. Further on she met a second rider, dressed in red and sitting on a red horse, and the sun rose.

Vasilissa walked all night and the next day, and towards evening she came to Baba Yaga's hut. The fence around it was made of dead men's bones; on the top of the fence were stuck human skulls, with eyes in them; instead of uprights at the gate were men's legs; instead of bolts were arms; instead of a lock was a mouth with sharp teeth. Just then another horseman rode by. He was black, dressed in black, and rode a black horse. He galloped up to Baba Yaga's gate and disappeared, just as if he had sunk through the ground, and night fell. The eyes in the skulls on the fence began to shine, and made the place quite bright. Soon a terrible roar was heard in the forest. The trees crackled and swayed about their branches, the dry leaves rustled, the wind sighed and moaned through the trees. It was Baba Yaga, who came sweeping through the forest trees, riding in a mortar and urging it on with a pestle. As she drove up to her gate she snuffed the air around her, and said: "Faugh! Faugh! I smell Russian flesh! Who's there?"

Vasilissa was nearly frightened out of her wits by this time, but she curtsied to the old hag, and said,—

"It's me, granny. My stepsisters have sent me to you for a light."

"Very good," said the Baba Yaga. "I know them. If you'll stop awhile with me first and do some work for me I'll give you a light. But if you won't I'll eat you."

Vasilissa, with the assistance of her doll, did all the work that was given her, and on the third day Baba Yaga gave her one of the skulls with blazing eyes from the fence, stuck it on a stick, and told her to take it home to her stepsisters. When she reached home it was bright day, and she was going to throw away the skull, but a hollow voice from the skull said:

"Throw me not away; carry me to your stepmother."

She was gladly welcomed at home, for they had had no light since she went away. They carried the skull into the sitting-room. The eyes glared at the stepmother and her daughters, and shot forth flames. They tried to hide themselves, but by morning were burnt to cinders. Only Vasilissa escaped. She eventually was married by a prince, took Baba Yaga into her service, and to the end of her life always carried her doll in her pocket.*

Another characteristic story is told about Ivanushka, the son of a *baruinya*, or lady, who was carried away in a whirlwind by Baba Yaga. His three sisters searched for him everywhere, and though each would find him yet they could not bring him home. They made Baba Yaga go to sleep by smearing her eyelids with pitch (a strange cure for insomnia), but when they were half-way home she awoke, and, chasing them, nearly scratched and tore them to pieces. At last the younger sister went to look for her

* "Russian Folk-tales," Ralston, p. 146. [Except for the fowls' legs, the account would do for an observatory of modern times, the telescope being the lady's long iron nose.—Ed.]

* Ralston, "Russian Folk-Tales," p. 158.

brother. Now Baba Yaga had a cat called Jeremiah, who was her favourite companion, and who had been the cause of the two sisters' failure. The younger sister made friends with Jeremiah by giving it butter, and tying a pretty ribbon round its neck. She found it seated on a stool opposite her brother, telling him Shazhas, or stories, and singing him songs. When the Baba Yaga awoke she told Jeremiah to scratch her eyes open, but the cat coolly told her to wait awhile till he had eaten some of the good butter the little girl had given him. Baba Yaga was furious, and threatened to crush him to death, but Jeremiah, after removing himself to a safe distance, spoke to her as follows: "As long as we have lived under the same roof, and as much as I have done for you, yet you have never once treated me kindly, whereas the little boy's sister has given me butter and tied a pretty ribbon round my neck."

In another similar story Baba Yaga became so angry with her butter-bribed cat that she pinched him to death for not waking her up in time.*

In the North, where the winds are cold and bleak, it is quite natural to look upon them as malevolent beings, full of mischief and spite. We have already observed this belief in the German, and the same appears to exist in the Russian folklore. Among the peasants the whirlwind is supposed to be a Vikhor, or bird. Once a certain king and queen went for a walk in the garden, and the Vikhor bird came and carried the queen away. Her three sons set out to look for her, and the youngest, Prince Vasily, found her. The queen concealed him, and Vikhor came flying in and spoke angrily to the queen. She gave her son a hint to come out from his hiding-place. He greeted Vikhor, and caught hold of his right little finger. Vikhor tried to shake him off, but in vain. At last Vikhor fell to the ground, and became a fine yellow sand. Prince Vasily kept the little finger, but, scraping the sand together, he burnt it in the stove.†

In Poland, when the whirlwind sweeps up the loose sand, it is supposed to be the evil spirit dancing. The magicians throw a sharp new knife into the sand to wound the spirit. A man who had a spite against another plunged such a knife into his threshold, and condemned him to ride for seven years around the world on a whirlwind. It is said that the whirlwind lifted the man, who was making haycocks in a meadow, and bore him away in the air.‡

In Norway the north wind is supposed to be a good-natured giant; but when a violent wind arises offerings are made to him to pacify him. At Bamberg it is said that an old woman snatched up her meal-sack whilst a storm was raging, and, opening the window, emptied it out, saying, "Dear wind, don't be so wild; take that home to your child!" She looked on the wind as a greedy lion or fierce wolf.§

In Norway the peasants say that the "giant stirs his pots" when there are whirlwinds or foul weather. In Sweden the popular belief is that a violent whirlwind is the Skogsrä, or wood-wife, who shakes the trees even to breaking, and rushes violently through the air. The Slavonians think that the whirlwind is a female demon, who flies up in the dust which the whirlwind raises. According to another legend, the whirlwind was a noble damsel who loved the chase above everything, and made havoc of the husbandmen's crops, for which she is doomed to ride along with the storm to all eternity. This recalls the Diana huntress deities and Holda.‖

* Ralston, "Russian Folklore," p. 177.
† Ralston, "Russian Folklore," p. 232.
‡ Grimm, "Teutonic Mythology," p. 632.
§ Grimm, "Teutonic Mythology," p. 636.
‖ *Ibid.* p. 633.

In conclusion, it is interesting to note how the southern myths differ from the northern—as greatly as the warm southern breezes differ from the bleak northern winds. The following Italian story is a good example:—

A fisherman who had had bad luck for some time, overcome with anger, cursed the Madonna and the saints. Suddenly a certain person (who, we are told, was the enemy of mankind) appeared to him, and promised him good luck if he would give him the next son he had when that son should be thirteen years old. The man consented, but when the enemy came to claim his prize the fairy Colina duped him and carried off the boy to her own palace. Lionbruno (the name of the boy) became her husband, but after a while wished to visit his home. On the way he had many adventures. After a long journey he came to a dense forest. Here he saw a little old hovel surrounded by dense wild shrubs, and with a little ivy-covered door. He could only reach it after climbing over inaccessible rocks. He knocked at the door, and an old woman opened it, who told him that she was Borea, the northwind. When she saw Lionbruno she asked him if he was not afraid, for this was the house of the winds, and if her four sons should return they would devour him. However, she hid him in a chest, and soon a loud noise was heard in the distance. It was the winds returning, and the noise grew louder and louder, as if the trees and branches were being swept away.

When they entered they began to say, "What smell of human flesh is here?"

"Here, Christians, Christians! Where is there any smell of human flesh here? Who would venture here?" said their mother.

Sirocco would not be convinced. At last Borea pacified them by promising to show them a man if they would not harm him. When she brought him out they puffed and blowed about him, and asked him many questions. They kept their promise and did not hurt him, and after a while Sirocco wafted him to the fairy Colina on a gentle breeze.*

In a modern Greek folk-song the winds are under the command of a sparrow-hawk, and they obey him. In another a mother sets three to watch her son while he sleeps. In the mountains the sun, in the plain the eagle, on the sea the brisk lord Boreas; the sun sets, the eagle goes to sleep, and Boreas goes home to his mother. From the context we understand that the eagle is the sweet soft wind, and Boreas the cool north wind.

HOW AMERICANS VIEW ENGLAND.†

WE often wonder whether the untravelled American's idea of Great Britain and the Britisher is as erroneous as John Bull's notions concerning America and Americans. To the American, England seems a phenomenal island, peopled by a race of men gifted with qualities approved by the centuries as "the fittest." For English ideas have survived. English purposes and intentions have ripened into immutable facts. English oppression has prevailed over the liberties of other peoples in all quarters of the globe. English avarice has piled up countless millions sterling. English commerce has gained a firm foothold in all the marts of the world. English armies have won laurels on thousands of battle-

* T. F. Crane, "Italian Popular Tales," p. 143.
† From a leading American paper "out West." In places, this article seems written in happy unconsciousness of the fact that races retain racial qualities for more than the six or seven generations which separate the Americans from the Old English parentage.

fields. English traditions, surviving the institutions they typify in Church and State, like the chrysalis that lately held the butterfly, though dead and soulless, have retained tinsel, glitter, and shapeliness. English scholars, peers of the Pagan masters, have given to modern times a literature robust with Saxon heroism and sanctified by an inspiration as pure as the whisperings of the muse in earlier days. English philanthropy has exemplified the innate nobility of the English heart, mothering within the scope of its ministrations the lorn and the outcast of all nations and climes.

But with all this, clouds of selfishness have ever obscured the British sun, and a vein of malevolence has predominated in British national character. An oppressor of the weak, her armies have been the butchers of countless defenceless peoples, sacrificed upon the altar of her ambition and avarice. Posing as a bulwark of Christianity, England has despoiled the children of the faith. English hands have for centuries dabbled in the blood of Christians. Themselves boastful of their liberties, for ages Englishmen have heartlessly forged chains for their neighbours, and ruthlessly slaughtered as recalcitrants and traitors such of their countrymen as scorned to bend the knee to wanton power, even though enforced by the sword and the gibbet. No century of English history but has witnessed her armies despoiling innocent communities, overturning inoffensive principalities, and her people clamouring for the blood of the nations despoiled by her cruelty. English tyranny has lost no opportunity to lay the weight of its relentless hand upon the weak and the defenceless. English cunning has over-reached the designs of the strong and the resolute. In peace a shopkeeper, with eyes intent for barter; in war, depending as much upon the power of her gold to corrupt as upon the power of her armies to vanquish her foes, Great Britain has more deeply graven her image upon the tablet of modern civilisation than any other nation of modern times.

This, in brief, is an American's opinion of Great Britain and the Englishman. It goes without saying that the American never wearies of criticising English classes and English customs. "Her Majesty," so rendered by the English royalist, who looks upon kingly blood as akin to divinity, we regard as a very fat and very benevolent old lady, neither better nor worse than any intelligent housewife, and not nearly as useful. The princes and princesses of the royal household we regard as so many appendages of an obsolete system, a trifle expensive, and entirely superfluous in a civilisation peculiarly eclectic in its instincts and methods. The lords and ladies we regard as a lower species of the same genus—not quite as respectable, and, if possible, more burdensome and useless to society.

THE WILD WEST; AND HOW ENGLISHMEN VIEW AMERICA.*

JUST now the Hon. Wm. F. Cody, better known as Buffalo Bill, is edifying the Londoners by daily performances of his Wild West combination, and the English press is printing columns of notices of the Nebraskan and his show, referring to it as a life-like reproduction of life in Western America. As one strong point of evidence this would lead to the belief that the English do really know less of America than the most careless Americans do of England.

* From the same Western paper.

The fact is that every American who bothers his head with the matter is glad that Buffalo Bill is having such a success, and this satisfaction is inspired by American admiration for anything that makes money quickly. Not that Americans care more for money than other civilised people—indeed they care less—but the mere fact that one of them makes a huge fortune by some big push is pleasing, and we seem to care very little whether he does it by a real-estate boom or a patent on a chestnut bell.

Thus, while Americans are pleased with Buffalo Bill's success, the smile is broadened in contemplation of John Bull's gullibility, for the fact is that the Wild West show no more represents America than the "Great Parisian Circus" would represent France, or than the play of "Romeo and Juliet" would present the phases of a modern love scrape.

The Wild West is as much a show to the people of Chicago as it is to London, and would draw as big a crowd, proportionately, in Cheyenne as it does anywhere else. The Deadwood coach, and the scenes with which Buffalo Bill surrounds it, are not prevalent in America, and only represent an incident in the history of the West, the same as if an English panorama should come to America and give among other pictures something presenting the plot of Guy Fawkes as a part of the history of England. In short, the Wild West does not represent America any more than Wild Bill's dress and hair represent the costumes which prevail in Missouri.

Yet, without having seen this personified creation of one or more of Ned Buntline's "yaller"-backed novels for several years, it is amusing to Americans at this great distance to see Buffalo Bill coddled by the Queen, fêted by the titled, lionised by London, and written about in the English press as the Hon. Colonel Cody, a member of the American Congress, and a high officer in the American army. And we shall have a big laugh with Bill about it when he gets back, for, in the democratic rank which prevails in this country, history will repeat itself upon Cody's return. He will be the Hon. Colonel William Cody until he strikes our shores; then he will be Colonel Cody perhaps as far west as Chicago; Buffalo Bill at Omaha; and "Bill, old boy," when he gets among his familiars at North Platte.

But in it all, and with it all, he will be a handsome, good-hearted, clear-sighted, and plain-mannered man of the West, who obtained his nickname by killing buffalo on a contract to furnish meat to the men who graded the Union Pacific, his military title as an honorary militia officer on the staff of the Governor of Nebraska, and his Honourable handle by once having been elected to the legislature of Nebraska, and at a time when he could not afford to take the seat, as he had other and more valuable business to attend to.

THE TOTAL SOLAR ECLIPSE OF AUGUST 19.

Although, as indicated in "The Face of the Sky" on p. 238, but little indeed of this phenomenon will be visible in this country; yet, as it will be observable in many parts of Russia fairly easy of access, we give a few details of the path of the moon's shadow over the earth. At Vitebsk, lat. 55° 11′ N., long. 30° 10′ E., totality will last for 2m. 23s.; thence the centre of shadow will travel a little to the north of Moscow; will pass through Jaroslav, lat. 47° 35′ N., long. 40° E., when totality continues about 2m. 30s.; to the north of Viatka (deviation of totality 2m. 50s.); across the Ural Mountains, and so into Russia in Asia; traversing which it passes over the Khirgan Mountains into Mongolia, and over Mantchooria and Japan into the Pacific to the north of Yedo. The maximum duration of totality (3m. 50s.) happens to the south-east of Lake Baikal. No effective observation of this eclipse will be obtainable from any point much to the west of St. Petersburg. Probably Vitebsk—which may be reached by the railway from Riga—is as easy of access as most stations.

Gossip.

By Richard A. Proctor.

The sensational announcement that the Star of Bethlehem had been seen near the zenith in Cassiopeia was doubtless, as I stated in last month's Knowledge, based on a mistaken idea on the part of the ingenious discoverer that, since Tycho Brahe had seen the new star of 1572 in the zenith, there the star would be seen again. But, finding that May is not the time for seeing Cassiopeia at night in the zenith, the faithful (and seemingly truthful) believer in the star of 1572 as the Star of the Nativity now announces throughout America, with much abuse of myself on *quasi*-theological grounds, that it was in the day-time he saw the star, using a method which the fogeydom of the professed students of astronomy would not allow them to think of. This wonderful method consists in the use of smoked glasses, to protect the eye from the glare of the sky, and also, in a manner not explained, in the use of reflecting mirrors attached to the telescope. Of course, says the discoverer of the Star of Bethlehem, "I did not expect to see Cassiopeia when below the horizon; but by means of these arrangements I have been able to see the constellation with the 'new star' in its midst, while still above the horizon in the day-time."

* * *

The only trouble is that, in correcting one error, the ingenious Professor Klein—such is the name and assumed title of the man—has fallen into another. Reminded that the constellations revolve annually as well as daily round the polar axis of the star sphere, and perceiving that, that being so, Cassiopeia, seen near the zenith in November, cannot be near the zenith in May or June, he has too hastily concluded, in his utter ignorance, that the constellation would be opposite the zenith, or far below the horizon, at midnight in the summer months. Were this so, he could of course safely pretend to have seen the new star by some novel device in the day-time; should the star be wanting when Cassiopeia came again into view at night, he could easily account for that by saying that in the meantime the star had died out. It has been, I expect, an unpleasing revelation to this worthy, that Cassiopeia does not pass below the horizon at night in the latitude whence he has so ingeniously observed the constellation in the day-time. So that, to save his credit for veracity, we must believe that the star shines for him brightly enough to be seen in the day-time, and goes out of view (for astronomers) so as not even to show the brightness of an eighth magnitude star at night! This seems to some degree improbable.

* * *

Mr. Haggard is to be congratulated on the resumption, in "Allan Quatermain's Story," of the style of writing in which he obtained a well-deserved success in "King Solomon's Mines." Both stories are capital books for boys, books, too, which men need not be ashamed to enjoy as thoroughly as the young folk. In such books a few mistakes in matters of detail count for little. We need not be troubled that the sun and moon do not usually behave as Mr. Haggard makes them behave in "King Solomon's Mines," or that a battle against forces numerically superior and equal in quality could not possibly be successful if conducted as Sir Henry Curtis conducts his battle with the forces of Queen Sorais and Nasta, in the later story. Both books remain exceedingly interesting even for those who recognise in them some such trifling absurdities; and though both are in places rather of the "blood and thunder" type, that, again, does not detract from, but rather enhances, their value as books for boys—aye, and for girls, too, and many grown folk also.

But an intelligent community must not allow too friendly reviewers to persuade them that "She" is other than false in taste and feeble in method (where it passes outside the book-for-boys style). "She" bears the same relation to what it was meant for that "Nana" bears to a healthy love story. It would have been well for Mr. Haggard if he could have explained that the work was the production of his boyish days when he was unable to distinguish good from bad in such productions as "The Epicurean" and its kindred. Unfortunately, and somewhat startlingly, he has to admit that he had never read Moore's two fanciful works (which one had thought every literary man must know well). It now appears that even the familiar "Peter Williams" has been newly discovered by Mr. Haggard since "Allan Quatermain" was written.

* * *

"Jess," "Dawn," and "The Witch's Head" indicate with tolerable clearness Mr. Haggard's limits.

* * *

Mr. Haggard himself tells us that he cannot write poetry, and so little thought anyone would suspect him of such weakness that he did not consider it necessary to mention that certain poetry in "Jess"—amazingly ill-placed, by the way—was written by another, even though that other was a woman and dead. He graciously acknowledges such matter in "Allan Quatermain," but only as "*put into rhyme* for him"—by his sister!

* * *

Three or four times during the last two years I have come across paragraphs in American newspapers, resembling the following from a New Orleans newspaper, but I have always supposed that the story told of mock modesty, really implying almost inconceivable impurity of mind, must be sheer invention:—

> A pitiful case of mock modesty occurred right here at home last week. One afternoon a party of young ladies and gentlemen went out sailing on the lake. A squall came up, and as they were hastening in to shore they were hailed by some gentlemen whose boat had capsized, and who, in danger of drowning, were clinging for life to its slippery sides. It seems that these young men had been out for a deep-sea bath, and were consequently nude. Owing to the storm they had been in the water for a long while, and one of the number was seized with cramps, and his alarmed companions thought he would die before help came. Now, any ten-year-old child who has ever tucked up its pantalets and gone wading in a creek knows that a person being in the water and seized with cramps will probably die if not rescued. As the yacht came up to the distressed bathers they explained the situation to those on her, and begged that the sick man might be taken aboard and a boat sent from West End to their own relief. But the mock-modest young ladies giggled and blushed, and I daresay peeped between the sticks of their fans, while vowing and declaring that they couldn't think of such a thing. They giggled again, but did not think to look the other way, and expressed themselves as horrified at the bare idea of rescuing a nude man from death. They had no thought for the suffering of the groaning young fellow down in the water being upheld by his anxious, dismayed, and exhausted companions. They were too busy giggling and commenting on the awfully embarrassing fact that the gentleman who desired to come on board hadn't his wardrobe with him. No, they would rather he died than be saved by them in his nude condition, and finally the yacht freighted with enough sham sentiment and mock modesty to sink it to the very bottom in a mile deep of ocean water, sailed off, compromising between the proprieties and a common humanity by promising to send help from the West End.
>
> It was not the fault of those young women whoever they were, whatever they are, that the man they abandoned did not die before help came, but it is their fault if some honest men and modest women had a lesson in sham purity and pretended innocence and a disgusted affectation of superior refinement and virtue that they will not soon forget.

* * *

But close by St. Joseph, where I live, an event of this kind, only with a more tragic ending, has taken place within the last few days, not two hundred yards from three members of my own family—two sons and my father-in-law. Such degrading "mock modesty" must be admitted as a reality in this case, anyhow.

* * *

Two young men, one the only support of his mother, the other but recently married, were bathing in Lake Contrary—five miles from St. Joseph. One or other got some injury in diving, or was seized with cramps—whatever was the trouble, one sank, and the other, the younger, was five times drawn down, each time coming back to the surface, and in his struggles rising above it almost to his waist. Each time he rose he called lustily for help, but there was only one boat near enough to have rendered help in time. In that boat were two young men and two—no, one would rather not say they were women—two persons of the female sex. Though the young men were close by, and cannot but have heard the cries of the swimmer, and the shouts of those near enough to see but not, like them, near enough to help—they took no notice, but rowed away from the drowning men, who both consequently perished.

* * *

This was witnessed by dozens, and there was so intense a feeling of disgust and horror that one rather wonders the young men were not tarred and feathered or otherwise maltreated. Yet the shameful fact was concealed, at the instigation doubtless of some of the persons concerned—and one of the St. Joseph papers did not hesitate to accuse of falsehood the editor of a Missouri paper who called attention to the murderous mock modesty of the female occupants of the boat. But, despite this denial, the event really took place as described above. The denial shows, however, that the community is very properly ashamed of the wrongdoing of some who still disgrace it by their presence.

Reviews.

Philip's Handy-Volume Atlas of the World: with complete Index and Statistical Notes. By J. Francon Williams, F.R.G.S. (London: Geo. Philip & Son. 1887. 3*s.* 6*d.* cloth.)—This work is something of a novelty; for with all the good points of an ordinary atlas, together with many more than are usually supplied at the price, the size of the volume (18mo.) gives it its chief utility. The cumbersome quarto is dispensed with, and the book may stand among volumes of ordinary size, or even be carried in the pocket where necessary. This will decidedly recommend it for school uses. There are sixty-four plates containing a hundred and ten maps and plans, and where greater detail is needed a country is mapped in sections. Thus England is shown on five scales—(1) in connection with the world; (2) in Europe; (3) in relation to Scotland, Wales, and Ireland; (4) alone; (5) in three sections. No further detail can be possibly needed in a general way. Plans of chief towns and their environs are given to the number of about forty, and the distinct marking of the railways is much to be commended. At the end of the book is a reference index of about 12,000 names. One of the best features of the book, however, is the table, clearly printed on the back of each map, of the chief features of the district depicted, giving all the particulars as to physical, political, and topographical geography that need be taught or learnt in schools. These tables have been compiled with great intelligence, and, what is rarer, limited by sound discretion. The book is well suited to schools, besides being adapted for private use.

Absolute Relativism. By Wm. Bell McTaggart, late Captain 14th Hussars. Vol. I. (London: W. Stewart & Co.)—Captain McTaggart apparently aims at the production of an eclectic system of philosophy, and occupies his first volume with the destruction of the bases on which materialism and idealism are respectively founded. His dissection of the fundamental propositions of these systems is marked by considerable acuteness, and his success in showing how and where they are respectively unsound is indisputable. Of his constructive capacity we have yet to learn, as the edifice which he is to raise from what he regards as metaphysically unassailable is to be elaborated in a future volume or volumes. Meanwhile he has produced a work of value to the thoughtful student. By the way, either his printer or himself is chargeable with some odd spelling in places. To take a single instance: he heads his preliminary remarks "Prologomena," instead of "Prolegomena," the word being derived from the Greek verb προλέγω; I speak beforehand; and not, as he seems to fancy, from πρόλογος.

The Wood-turner's Handybook. By Paul N. Hasluck. A.I.M.E. (London: Crosby Lockwood & Co. 1887.)—This is the second of the valuable series of mechanical handbooks by Mr. Hasluck now in the course of publication by Messrs. Crosby Lockwood & Co., the first of which ("The Metal-turner's Handybook") we noticed on p. 212. Written by a man personally familiar with the tools he describes, it may be cordially recommended as a most useful work to all beginners in the fascinating art of turning. Explicit and well-illustrated directions are given for making a considerable variety of articles, both useful and ornamental, and the possessor of a lathe will find in its pages material to keep him pleasantly and profitably employed for some time to come.

Screw Threads. By Paul N. Hasluck. (London: Crosby Lockwood & Co. 1887.)—Addressing a somewhat more limited public than the volume reviewed above, this little book, constructed to go into the waistcoat pocket, pretty exhaustively discusses the question of screw threads and screw-cutting generally. It should be in the possession of every metal-turner, engineer, and machinist.

School Hygiene. By Arthur Newsholme, M.D. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—In nineteen chapters, Dr. Newsholme treats elaborately of school architecture in its sanitary aspect; of mental and physical exercise, diet, dress, rest, and bathing as affecting the health of children; of their eyesight; of the communicable diseases which arise in, or are brought to, schools; and of school accidents and their immediate treatment. Both parents and schoolmasters will find much in the volume before us which is worthy of their most serious consideration.

The Mystery of Gravity, &c. By J. Fraser, C.A. (London: Wyman & Sons. 1887.)—The mystery of gravity is that it is—heat! Last September we reviewed a book in these columns (Knowledge, vol. ix., p. 342) by Mr. Kedzie, in which Mr. Fraser's theory of bodies shielding each other, and so being, as it were, pushed together, was anticipated. Mr. Fraser, alike with Mr. Kedzie, quite ignores the fact that, were his hypothesis true, bodies would attract each other in the proportion of their sectional areas, and not of their masses at all.

History and Work of the Warner Observatory. (Rochester, New York. 1887.)—In the first part of this work Mr. Lewis Swift gives a general description of the observatory and its contained instruments; a list of the winners of the prizes offered for the discovery of comets; a catalogue of nebulæ discovered by the author, and miscellaneous observations of the physical structure of two well-known nebulæ, and of the tail of the Pons-Brooks comet. The second portion of the book is occupied with the Warner prize essays; the first one by Professor Lewis Boss, on comets, forming a really valuable addition to popular knowledge of those mysterious bodies. This is followed by four on the sky-glows of 1883–84, of which the third, by Mr. H. C. Maine, of Rochester, New York, is the only one really worth the trouble of reading through. The other three are seemingly dependent upon *Nature*, alike for their "facts" and inferences; whence their scientific value may be pretty well estimated.

My First Trigonometry. By M. H. Senior. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—Mr. Senior plunges at once into analytical trigonometry, and, moreover, wastes several pages over the absolutely valueless centesimal measurement of angles; but, despite this, he has produced a remarkably useful little volume. His chapter on logarithms, particularly, is excellent. "Hyp" has apparently dropped out of the first fraction in s. 28 on p. 22.

Practical Solid Geometry. By Major W. G. Ross, R.E. (London: Cassell & Co. 1887.)—This is an introduction to geometrical drawing on the orthographic projection, as applied to the delineation of a tract of country in its military aspect, of the plan of a fortification, &c. The system of vertical indices is also explained, and contouring touched upon; while the isometric projection and the elementary principles of shading are dealt with more or less fully. To military students who have the advantage of a tutor, Major Ross's small volume will be found valuable; but it will require the most sedulous attention from all who are self-instructed if they are to derive much advantage from it.

Instantaneous Photography for Amateurs. By C. W. (Bath: Charles Steen. 1887.)—This pamphlet contains a description of the "diaphragmatic shutter," in which exposure is effected by the crossing of two apertures between the two members of a camera lens. Its author claims for his arrangement that it admits of the time of exposure being accurately regulated between ·01 second and several minutes.

An Elementary French Grammar. By Dr. V. de Fivas, M.A., &c. (London: Crosby Lockwood & Co. 1887.)—Familiar as is the name of Dr. de Fivas in connection with the study of the French language, we naturally expected that an elementary work on that subject from his pen would be well and conscientiously done. Nor have we been disappointed in the perusal of the one before us, inasmuch as the student who thoroughly masters its contents will have laid a very sound foundation for the acquisition of a perfect knowledge of French.

The Bible and the Age. By Cuthbert Collingwood, M.A. and M.B. Oxon. (London: T. Fisher Unwin. 1886.)—Yet another specimen of wasted labour and misdirected ingenuity. In writing we convert, so to speak, our immaterial ideas into material signs—signs which possess, and can possess, no identity with those ideas, but in a familiar sense "correspond" with them. Here, then, is the whole mystery of Mr. Collingwood's biblical exegesis. The science of the Bible is no science at all, and its history (where it has any historical basis) is only ancillary to the spiritual lessons taught by it. The man who reads the first chapter of Genesis, in the belief that he is perusing an account of a series of objective facts which really happened, is simply deceiving himself, as the story of the Creation, of the material universe, the appearance of Adam and Eve, and all the rest of it, is myth and allegory pure and simple. Some of the Bible is inspired and some is not. The Gospels and Apocalypse, for example, are in the former category; the Epistles have no claim to inspiration whatever. All this is modestly described on the title-page as "An elucidation of the principles of a consistent and verifiable interpretation of Scripture"!—apparently in the most sublime unconsciousness that the same system might be applied with equal success to demonstrate the Divine origin of the Veda, the Korán, or even of the "Gold Plates" of that lamented prophet the late Joe Smith himself. Of Mr. Collingwood's quasi-Papal dogmatism, and of his curious want of appreciation of the real difficulties which beset men of science in connection with the perfectly definite statements contained in the Bible, it is needless to speak at length. Save for a horrible dread that it would lead to the publication of reams more of such stuff, we would suggest that Mr. Kinns and he should discuss the question of the interpretation of the account of the Creation with which the Bible opens. Who would convert whom would be a matter of very curious speculation indeed.

Cassell's Latin-English Dictionary. Revised, enlarged, and partly re-written. By J. R. V. Marchant, M.A. (London: Cassell & Co. 1886.)—When we contrast the volume whose title heads this notice with the Dymock's "Ainsworth" to which lads were condemned in the days of our fathers, we cannot help congratulating the present race of schoolboys upon the appearance of so valuable an aid to an intelligent study of classical Latin as this. Among the excellent features which distinguish Mr. Marchant's book may be mentioned the very numerous quotations from the most familiar Latin authors, illustrative of the different meanings and use of words, the etymologies, and the historical and geographical explanations introduced into so many of the various articles. As a dictionary to aid a middle-form boy at a public school in construing, it would not be very easy to improve upon the one before us.

British Stalk-eyed Crustacea and Spiders. By F. A. A. Skuse. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—Yet another volume of the delightful "Young Collector" series, in which Mr. Skuse discourses in an interesting way of those two popularly ill-understood classes of the Arthropoda, the Crustacea and the Arachnida of the British Islands. Surely no intelligent lad or young man can read this little book through without being inspired with a burning zeal to study and collect lobsters, crabs, prawns and spiders straightway. Within its 128 pages will be found a description of the structure, habitat, and manners and customs generally of all the well-established British species of the creatures treated of, with explicit directions for capturing and preserving them for study. No less than thirty-seven well-executed wood-engravings (one containing twelve or fourteen separate figures) illustrate the text, and render easy the identification of any specimen the collector may secure. We neither know, nor pretend to know, anything of publishing in its strictly commercial aspect, but we fail to see how such a work as this can yield a profit at the singularly low price charged for it.

Yussuf the Guide. By Geo. Manville Fenn. (London: Blackie & Son. 1887.)—Albeit Mr. Fenn is scarcely at his best in the work before us, he has given us a sufficiently stirring story of the adventures of a sick lad restored to health and strength by a journey in Asia Minor, in company with his two guardians, Mr. Preston, a University professor, and an altogether impossible lawyer, Mr. Burne. In Smyrna they pick up Yussuf, who subsequently acts as their guide through the wild country which they explore: a Turk so grave, patient, brave, resourceful, and gentlemanlike that he may well have been drawn from the life. The account of the escape of the party, together with another Englishman and his wife from the mountain fastness of the brigands, who are holding them for ransom, will be read straight through by every boy without laying the book down.

Of school books on our table we have *Moffatt's English Grammar* (London: Moffatt & Paige), suitable enough for ordinary middle-class schools and Civil Service examinations; and *Cassell's Combination Test-Cards* (London: Cassell & Co.), consisting of packets of cards containing arithmetical questions up to the Seventh Standard. If we admit the necessity of teaching the more recondite branches of arithmetic to children who have to earn their bread by daily labour, these cards seem well adapted to their purpose. For ourselves, we should regard the time as much better employed in instructing the boys how to dovetail pieces of wood, and the girls to scrub out a room or cook potatoes.

THE FACE OF THE SKY FOR AUGUST.

By F.R.A.S.

THE student will, of course, watch the sun for the spots which have begun to appear on the sun after a protracted period of quiescence. During the early morning of August 19 there will be a total eclipse of the sun, but only the end of it will be visible when the sun rises (in, and in the neighbourhood of, London) in the E.N.E. at 4h. 53m. A.M. At this time the effect presented will be that of a small black semicircular notch cut out of the S.E. part of the sun's disc. The eclipse will end at 5h. 6·7m. A.M., so that scarcely anything of the phenomenon will be seen in Great Britain. The aspect of the night sky is shown in map viii. of "The Stars in their Seasons." Shooting stars should be looked for on the night of August 10. Watch may, in fact, be kept on those immediately preceding and following it. Mercury is a morning star throughout the month, and attains his greatest western elongation (18° 36′) in the evening of the 16th. He may be caught by the naked eye about the middle of the month before sunrise to the north of east, near the horizon. Venus is an evening star all through August. She attains her greatest brilliancy on the 16th, and about that date may be seen with the naked eye in bright sunshine by anyone who knows exactly where to look for her. In the telescope she looks like the moon when about four days old, and is a lovely object. Jupiter is low down in the west in Virgo, and is only fairly visible at all early in the month. Saturn, Uranus, and Neptune are one and all invisible. The moon is full on the 3rd at 8h. 40·1m. in the evening, enters her last quarter at 11h. 36·5m. P.M. on the 11th, is new at 5h. 38·6m. A.M. on the 19th, and enters her first quarter at 8h. 21·2m. in the evening of the 25th. There will be a partial eclipse of the moon during the afternoon and evening of the 3rd, but at no time will more than ·419 of the moon's diameter be obscured. When the moon rises in London at 7h. 35m. P.M., she will already be immersed in the earth's penumbra, and her first contact with our shadow will be just beginning. The middle of the eclipse will happen at 8h. 48·9m. P.M.; the second contact with the shadow at 10h. 2·1m.; and the last contact with the penumbra at 11h. 25·9m. P.M. Five occultations of fixed stars by the moon will occur during August at hours more or less convenient to the ordinary amateur observer. On August 8, 26 Ceti, a star of the 6½th magnitude, will disappear at the moon's bright limb at 11h. 57m. P.M., at an angle of 105° from her vertex. Its reappearance will happen at 1h. 2m. the next morning at the dark limb of the moon at an angle from her vertex of 240°. On the 22nd, 65 Virginis, of the 6th magnitude, will disappear at the moon's dark limb at 8h. 34m. P.M., at an angle of 92° from her vertex. She will have set before it reappears. On the 27th, B.A.C. 6081, of the 6th magnitude, will disappear at the dark limb at 5h. 59m. P.M. at an angle of 51° from the vertex of the moon, reappearing at her bright limb at 7h. 14m. P.M. at a vertical angle of 277°. On the 28th, ξ^1 Sagittarii, a star of the 6th magnitude, will disappear at the dark limb at 6h. 54m. P.M. at a vertical angle of 36°, its reappearance at the bright limb of the moon happening at 7h. 56m. at an angle of 301° from her vertex. Lastly, on the 31st, 45 Capricorni will disappear at the moon's dark limb at 15 minutes after midnight at an angle from her vertex of 108°. Its reappearance will not happen until between 1h. and 2h. A.M. on September 1. At noon on August 1 the moon is in Sagittarius ("The Seasons Pictured," plate xxi.), which she quits for Capricornus at 10 P.M. on the 2nd. She remains in Capricornus until midnight on the 4th, and at that hour enters Aquarius. Her passage through this last-named constellation occupies until 2h. A.M. on the 7th, and she then passes into Pisces ("The Seasons Pictured," plate xxii.), in which great straggling constellation she is travelling until 7h. 30m. A.M. on the 10th. She then arrives at the boundary of the most northerly part of Cetus, and when she has traversed this, at 5 o'clock the next morning, she enters Aries ("The Seasons Pictured," plate xxiii.). At 2h. 30m. A.M. on the 12th she passes out of Aries into Taurus. Travelling through Taurus, we find her at 11h. P.M. on the 14th on the confines of the northern prolongation of Orion. She passes through this in 1½ hours, and emerges in Gemini. Her journey through Gemini is completed by 4h. A.M. on the 17th, when she crosses into Cancer ("The Seasons Pictured," plate xxiv.). Here she remains until 2h. 30m. in the afternoon of the 18th, at which hour she enters Leo. She leaves Leo for Virgo at midnight on the 20th ("The Seasons Pictured," plate xxv.); and Virgo, in turn, for Libra at 9h. P.M. on the 23rd ("The Seasons Pictured," plate xxvi.). The course of her journey over Libra brings her, at 4h. 30m. P.M. on the 25th, to the western edge of the narrow northern strip of Scorpio, through which she has passed by 1h. 30m. next morning, and come out in Ophiuchus. At 6 P.M. on the 27th she quits Ophiuchus for Sagittarius. She is travelling through Sagittarius until 4h. A.M. on the 30th, and then leaves it and enters Capricornus ("The Seasons Pictured," plate xxi.). She is still in Capricornus at midnight on the 31st.

An extraordinary mistake, or misprint, appears in "The Face of the Sky for July," where the occultation of Aldebaran by the moon, which really occurred at 3h. 16m. in the early morning of the 17th, is announced to happen in the afternoon! of that day; and "bright sunshine" is printed for "bright twilight."

Our Whist Column.

By "Five of Clubs."

MATHEWS ON WHIST.

(Rearranged, partly rewritten, and occasionally corrected in accordance with modern views.)

PLAY SECOND HAND—*continued.*

IF you are strong in trumps, and have the Ace, King, and two more of your right-hand adversary's lead, there are two ways to play:—Either pass it the first time, or else put on the Ace, and play the suit on to force your partner. If weak in trumps put on the Ace, but do not continue the suit. [In modern play the King would be the right card to put on. Moreover, in some cases, you would not, when strong in trumps, follow either of the courses here suggested, but play the King and lead trumps. Even if weak in trumps, it would sometimes be well, with such command in one adversary's suit, to lead trumps, after playing the King. Especially if your partner had declared strength in another plain suit, while you had protection in the third.]

Holding Ace, Knave, ten, and a small card of the suit led by your right-hand adversary, it is best in trumps to play the ten, the small card in plain suits. For in trumps a good player with King, Queen leads the lowest; in other suits the King. Thus in the latter case an honour is certainly behind you [that is, either on your left or with your partner], and in whichever hand it may be, you can do no good by putting on the ten. By keeping the three together, you make it impossible for your adversary to get one trick in the suit [if your partner holds the honour, while the adversaries can make but that trick if the one on your left holds it and returns trumps]. [If, however, you have an established long suit, and no re-entering card in plain suits, it is better to play the small card even in trumps; for this reason, that you thus have a better chance of making the last trick in trumps and bringing in your long suit. It is to be remembered that though the lead of a small trump is made by good players from King, Queen, and others, it does not necessarily imply that the trump leader holds both King and Queen, even though you hold Ace, Knave, ten, and another. On the contrary, it is rather more probable that he does not than that he does.]

There are situations where even good players differ. If a Queen is laid on your right hand, and you have Ace or King, and two small ones, you should certainly cover the Queen. But if you have Ace or King, ten, and a small one, it is better to pass the trick, for after passing you remain with the major tenace if your partner take the trick with King or Ace, and the original leader cannot make a trick in the suit. If you had covered, he must have made a trick (apart, of course, from ruffing), as he would lie with minor tenace against the major tenace between you and your partner—assuming the King or Ace with your partner. If your partner has the Knave, passing the Queen loses a trick; but the odds are greatly against this. [If the lead has been from four cards, leader cannot have followed the accepted principles of play if as second place you hold ten: for these only allow the lead of Queen from Queen, Knave, ten, &c., except in cases of emergency, when Queen may sometimes be led from Queen, Knave, nine. The play also in the case considered would depend partly on the score and on your strength in trumps.]

Play Second Hand, Second Round.

It frequently happens that the adversary on the right hand, having won his partner's lead with the Ace or King, returns the Knave. In this case do not put on the Queen, as the probability is that, if you play a small card, third player will not finesse, but play the best if he hold it. On all such occasions, however, play without hesitating, lest you should direct a skilful adversary to an advantageous finesse.

If your right-hand adversary wins, and returns his partner's lead, should you hold the best and a small one, play the small one. Third player will probably finesse (if holding the second and fourth best, or second best to fourth best led), so that if your partner has the third best he will probably make it. If your adversary on the left is a bad player, however, I would not advise this; for bad players never finesse when they ought to. [If you are weak in trumps it is unsafe to venture on underplay of this sort, unless it is done in order to retain command in the one suit of which you are afraid, for which purpose it is sometimes the most prudent course.]

Play Third Hand.

Win with the lowest of a sequence to show your strength in your partner's suit. [In modern whist it is considered best to play the lowest (if any card) of a sequence to a trick, alike to the lead of an adversary and to a partner's lead, save on those rare occasions when underplay is proper; but, as will be seen under that head, Mathews considers it often desirable to keep the adversary in ignorance, in his own suit, by playing the highest of a sequence.]

If your partner leads the nine or ten, and you have an honour with only one small card, put on the honour. If with the honour you hold two or more small ones, do not put on the honour. If you hold Ace, whether with one small card or more, put on the Ace invariably, for it is better that your partner should finesse in his own suit than you.

When your partner leads a card of which you have the best and third, and your right-hand adversary puts on the fourth, the second only remaining, it is a commonly received but erroneous opinion that the chance of succeeding in the finesse is equal to the chance of failing; but calculation will show that as the last player has one card more than his partner, the chance is in corresponding proportion in favour of the second best lying with the fourth player. For example, if second and fourth players held each of them three cards, the odds will be three to two against the finesse succeeding.

[The play of the fourth best second in hand is, however, in itself suggestive either of shortness in the suit, or of finesse. If the fourth is the lowest of two, the other is of course the second, and your finesse is safe. If fourth player holds no more, then your finesse is useless if your partner holds second best, and a failure if fourth player holds it—the next round being probably ruffed. Regarded as a matter of probabilities, note that the play of fourth best, by showing that a number of small cards in the suit lie between the fourth player and your partner, diminishes the probability that second best lies on your left. On the whole, it is best to play the third best, unless a single trick is wanted to save or win the game or make a particular point.]

[Mathews does not consider specially the case of Ace, Queen, with or without others, here or anywhere else. We may safely conclude from his silence that the finesse of the Queen, except where one trick wins or saves the game or a point, was regarded in his time as too obvious to need enforcing. It is clear from his remarks on the finesse that he would not have had any doubt as to the propriety of the course now customarily adopted. The cases immediately following clearly show this. In fact, players finessed more boldly in Mathews' day than they do now.]

With Ace, Knave, and another, finesse the Knave to your partner's suit if strong in trumps; but, otherwise, play the Ace. In trumps, with Ace, Knave, and another, it is always right to finesse the Knave to your partner's lead.

[The finesse of the Knave is decidedly wrong, both in trumps, and with a plain suit whether you are strong or weak in trumps. In every case, play the Ace and return the Knave; you will save five tricks in the long run by pursuing this course for two that you will lose.]

If your partner leads ten, and you hold Ace, Knave, and another or others, pass the ten invariably—unless one trick saves or makes the game or a particular point.

If your partner leads the Ace and Queen of a suit, of which you have the King and two others, win his Queen that you may not stop his suit. [Leading Ace, then Queen, indicates the Knave in reserve: but before the distinction was adopted of leading the Queen second if with no more than four in suit, and the Knave if with five or more, Mathews' rule of covering the card led from the remaining top sequence was too absolute. It would be wrong, for instance, if your partner had shown such strength in trumps or plain suits that you could feel sure of his re-entering. For by taking his Queen you may leave his long suit protected in the adversaries' hands, where by passing, you and he are able to take out four rounds in the suit certain. This applies to our modern play of the Knave: there are cases when the King should not be played, precisely *because* the lead of the Knave indicates length in the suit—though usually the Knave calls for the King.]

If your right-hand adversary "calls" for honours, and your partner leads through him, if you hold Ace or King with nine and a small one, you should finesse the nine.

[This is one of the few rules given by Mathews which applies specially to long whist. In short whist the occasion for this finesse arises if your right-hand adversary, especially if he has turned an honour, calls for trumps. Because then your partner, leading through him notwithstanding the call, shows such strength that the finesse of the nine is probably safe. It is better, though, from Ace, nine, than from King, nine. In either case, if the nine makes, lead the high card at once: it is the best way of helping your partner against the enemy's trumps, which lie weak on his right, strong on his left.]

If, after ten tricks have been played, there remains one entire suit [save for a solitary discard], and your partner lead, you holding King, ten, and another, your play must depend on the position. If you have made five tricks, or otherwise need two for a particular point or to save or win the game, put on the King. But if you have made six, or need but one more point, you can make sure of it thus:—If your right-hand adversary put on an honour, win it [you thus remain with the second best guarded]; if he plays a small one, put on the ten [and still you remain with guarded second best].

Our Chess Column.

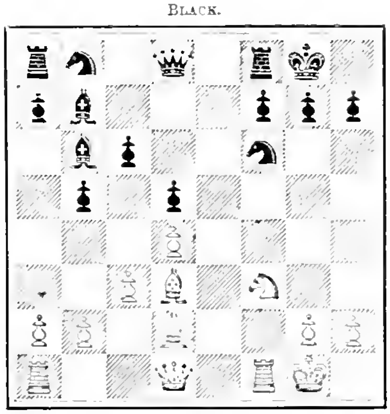
By "Mephisto."

ENDINGS FROM ACTUAL PLAY.

A singularly ingenious termination of a game, wherein White had given the odds of a Knight.

Amateur.

Black.



White.

Mr. F. H. Lewis.

White proceeded as follows:—

Kt to Kt5	P to KR3
R × Kt	

The first of a series of brilliant moves. If Black play either P × R or P × Kt, White would reply with Q to R5, and would soon obtain a mating position.

	Q × R
Kt to B7	Q to R5
Q to B3	

Following up the attack, and better than Kt × R, if Black play R to Ksq, White would continue with R to KBsq, &c.

	Kt to Q2
P to KKt3	Q to K2
R to Ksq	Q to Qsq
Q to R5	Kt to B3

This looked a likely move.

Q to B5

Very good! Threatening Kt × Kt (ch) and Q to R7 mate.

Kt to Q2

Curiously enough, there is nothing better but to retire.

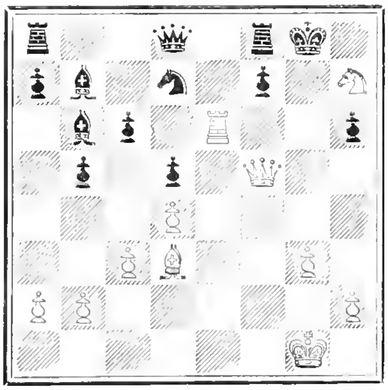
B × P!	P × B

If Black play anything else, his general prospects would not improve much—*i.e.*, P to Kt3. Q to R3, and if K × Kt, B to Kt5(ch)!

R to K6!

AMATEUR.

BLACK



WHITE.

MR. F. H. LEWIS.

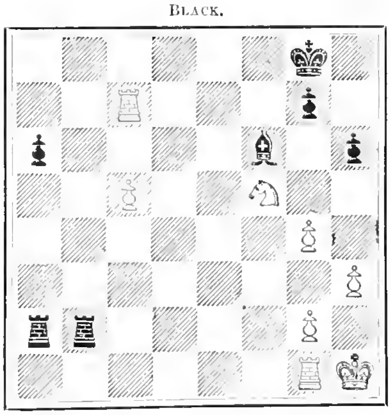
A most remarkable combination of brilliant moves that do not often occur in actual play.

	P × R
Q to Kt6 (ch)	K to Rsq
Kt to Kt5!	Q to K2
Q × P (ch)	K to Ktsq
B to R7 (ch)	K to Rsq
B to B5 (ch)	K to Ktsq
B × P (ch)	Resigns.

Another curious ending played by the same player:—

AMATEUR.

BLACK.



WHITE.

MR. F. H. LEWIS.

The game terminated as follows:—

White.	Black.
	R to Kt6

Played, no doubt, in the hope of bringing about a surprise mate by means of B to Kt, followed by R × RP (ch).

R to Ksq.

This is an attacking as well as a defensive move.

	P to QR4
Kt × P (ch)	

Black intended to surprise his opponent, and did not therefore expect to be attacked himself.

	K to R2
Kt to B5	P to R5
Kt × P	

A brave and captivating Knight!

B × Kt

It is plain that White can equally win if Black does not take the Knight.

KR to K7	R to Kt8 (ch)
K to R2	R (Kt8) to Kt7
R × B (ch)	K to R3

Black was mistaken in believing that this would give him a better chance for escape than K to R sq.

K to Kt3!

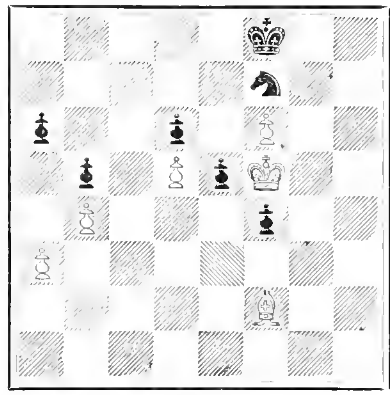
Good! If R to R7 (ch), Black escapes *viâ* K to Kt4.

	R × P (ch)
K to R4	Resigns

End position in the fourteenth game of the match Blackburne *v.* Zukertort:—

BLACKBURNE.

BLACK.



WHITE.

ZUKERTORT.

Black won as follows:—

	Kt to R3 (ch)
K to Kt6	K to B2

A very subtle manœuvre, which forces the game. If White, instead of taking the Kt, would play anything else, say B to R4, Black wins by Kt to Kt sq. K to B5, P to B5, and Black, by giving up his BP, obtains both the White P's on B6 and Q5, remaining with two passed Pawns ahead.

K × Kt	K × P
K to R5	K to B4
B to R7	P to K5
K to R4	P to K6
K to R3	K to K5
K to Kt2	P to B6 (ch)
K to Kt3	P to B7
K to Kt2	K to Q6
Resigns	

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LONDON: SEPTEMBER 1, 1887.

WOLF, MASTIFF, AND SPANIEL.

I REMEMBER once, in Boston, being startled and somewhat pained to hear America's great humorist, Wendell Holmes, enunciate the opinion, with which, as expressed in print, I had long been familiar enough, that, as seen from certain points of view, Englishmen are children compared with their American cousins. I was not comforted by the remembrance that in his "Professor at the Breakfast-Table," where the opinion is expressed, he had said that he would not let out the fact of the real American feeling about Old World folk, except in converse with Englishmen sensible enough to avoid mistaking the feeling for personal conceit. Unfortunately, the proposition has at least some degree of truth in it, though be it noted that an immense proportion of the American population are fully as childish about the same matters, though in another way.

Holmes was talking, however, of Americans of the old England type—to be found throughout the States, but certainly not forming the majority of the present American people. It must be admitted even by the most anti-Bostonian Americans (who, indeed, may abuse Boston, but Americans are all proud of her) that the old England type is the most innately independent type of manhood the world has known. People more free-and-easy, more don't-care-a-cussative, if one might use such a word, there are in other parts of America, as, indeed, there are in many parts of the old country—the mining districts for example—but there are none who have more definitely, more logically, or therefore more thoroughly adopted the faith that men are entitled to full freedom and individual independence.

It is true enough, as Holmes has said, that "a whole museum of wigs and masks and lace coats and gold sticks and grimaces and phrases is still used in the Old World puppet-shows." "I don't think," he says, "that we Americans ever understand the Englishman's concentrated loyalty and specialised reverence. But then we *do* think more of a man as such (barring some little difficulties about race and complexion we will touch on presently) than any people that ever lived did think of him. Our reverence is wider, if it is less intense. We have caste among us to some extent, it is true; but there is never a collar on the American wolf dog, such as you often see on the English mastiff, notwithstanding his robust, hearty individuality."

If the collar is now very often not seen on our English mastiffs, it is too true, as Holmes has said elsewhere, that the mark of the collar is apt to be left. Considering the English people generally, it may be said that true freedom of thought is tolerated only, not welcome in England, at present. It is "struggled up to and held antagonistically, not spontaneously," save in a few altogether exceptional cases, where men who were in advance of their time a few generations back have handed down as a family tradition a true faith in the dignity of manhood, and the right of men to individual independence.

Such exceptional cases are not understood, I think, by Americans, even by such as Holmes, Emerson, and the like; nor can they readily understand that in other cases fulness of mental freedom may be attained even by those who at a great price have purchased it. "You may teach a quadruped," says Holmes, "to walk on his hind legs; but he is always wanting to walk on all fours." The comparison is unfair, and a trifle rude, a fault not common with Boston's genial humorist. The freedom of mind which Holmes regards as the birthright of America has come to the American through his English blood. It has fuller play in America and so finds freer expression; but it is of English origin. When that freedom was won, America, regarded as a nation, had no existence. Britons in America fought Britons from over the water (Britons ruled by a German king) for freedom, and fought successfully—even as Englishmen at home fought other Englishmen, ruled by a Scottish king, for their rights a century before, and won them.

When America first became American, liberty had already been achieved for the new-born nation. And if, at this day, the whole population of England could be transplanted to America (as a consequence of some such event as Emerson imagined in his "English Traits," and as some less friendly Americans conceive, oddly enough, to be probable) the result would be not a diminution of America's independence of feeling, but a vast development of it. There would be a new growth of Bostonian Americanism (by which I mean the spirit of resistance to popular as well as to personal tyranny), not any retardation of America's development as a great free nation.

Unless I am greatly mistaken—and if I am many Americans have made the same mistake—such dangers as there are for America's future would not be increased, but measurably diminished, by any considerable influx of that strain of British blood to which America owes the men who made her what she is, as well as those of the present era who stand highest in European esteem. It would be idle to say that America's future is threatened by no dangers; Englishmen in particular recognise one danger to which America is exposed, against which all the resolution of her most steadfast citizens will ere long be required. Her friends hope, and fully believe, that she will surmount the dangers which lie ahead, even as she has surmounted those which surrounded her in the past. But it is an easy prophecy to say that if or when she overcomes those dangers it will be by the exercise of qualities akin to those which the great Americans of a century ago displayed—and those Americans were, without exception, British—purely British by birth or by descent, and actually British in the sense in which Canadians, Australians, and Cape Colonists are regarded as British until such time as they cast loose the ties which connect them with their kinsfolk in the old home-nest.

Those take but a purblind view of history as well as biology who imagine that three or four generations—or ten or twelve, for that matter—affect the quality of race blood; insomuch that Americans who abuse British qualities, and Englishmen who abuse American qualities, show themselves (individually only, thank God!) of the nature of those birds whom the good old proverb denounces because they "foul their own nest."

It cannot, unfortunately, be denied that in the England of to-day false loyalties are still rife, though they are steadily diminishing in prevalence. When Gorgius IV., of Brentford, visited Haggisland (as Thackeray presents the "o'er true tale"), the Baron of Bradwardine—a man worth more to the human race than all the stalwart Porkers of Brawnswick who ever ruled over Brentford, or than even all the monarchs who have swayed the destinies of greater nations—abased himself before that padded humbug. But probably while Gorgius IV. was alive not five in ten saw aught of degradation in such abasement, and not two in the five would have ventured to express their feelings. Many doubtless envied the Sheriff his right (let us hope he had some right) to pocket the goblet out of which the First Gentleman in Europe—alas, I have let the august cat out of the awful bag! I should have said, "the august and most gracious ruler of Brentford"—had taken, after his fashion, more wine than was good for him.[1]

The great man—most emphatically, I do not mean Gorgius IV.—by an odd chance, sat down on the goblet, and not only broke it into fragments, but ruined his own coat-tails. Many laughed when they heard of this. But it was not because they thought his purpose of consecrating that goblet to future uselessness was an absurd one. They only laughed, after the fashion of human nature, because that purpose had failed. Many in those days—and, alas! I fear many are of the same mind now—would not have thought it altogether absurd if Sir Walter Scott (again the cat gets out of the bag—I should have said the Baron of Bradwardine) had made a pennon of his damaged swallow-tails, and let them wave thereafter in the baronial halls of Bishopsbridge in memory of the service in which they had suffered injury.

In our times manners and customs are no longer as they were in the "good old days" of Brentford. Snobs there are and always be; these poor (in spirit) we have always with us. When we remember how a set of snobs (women, too, whose degradation pains the mind more than any number of masculine snobs) rushed in where a certain princess had been eating cherry-pie, and seized the cherry-stones left by her august lips upon the precious plate whence she had eaten, and preserved those rather unpleasant objects as sacred relics—we cannot speak of the Brentford people as altogether regenerate even in these days. I have even heard of American women who have not felt it degrading to proclaim that they have lost no chance of seeing—*seeing!*—the niece of Gorgius IV., now Queen in Brentford. But at least no one whom the world respects has ever debased himself in our time, or in any British country, as did Bradwardine's Baron when the century was yet young.

A yet better sign is this, that those who in our time reject the false loyalties which degrade no longer show by a contrary fault how strongly the spring had been bent the other way! Men are beginning to learn in my own loved country, as the wiser have long learned in the United States, that it is a weakness to be moved either one way or another by titles and dignities, by wealth, by influence, or by power. It begins to be recognised that one who shows either subservience on the one hand, or discourtesy on the other, towards those whom the silly cant of old times called persons of rank (as if there were only one way of ranking people, and that way a foolish one), or whose conduct is *in any respect whatsoever* different towards them from what it would be towards others possessing similar qualities, mental and moral, has not yet reached the dignity of full-grown manhood. Such folk are not, indeed, to my judgment, rightly described by Holmes as "children," in the sense in which the savage is a child. They are rather the hobble-de-hoys of civilisation. Their "your majesty," "my lord," and so forth suit them very well, even as the "sir" with which the stripling continues to address the pastors and masters of his boyhood is appropriate enough to the stage of life through which the lad is passing. It is better than discourtesy, precisely as the formal politeness of the youth to those above him for the time in standing and experience is better than a brusque manner or rude demeanour, and promises a more dignified manhood. But it is only appropriate where there actually is a difference of standing in the qualities constituting the fulness of manhood; and no man who respects the dignity of manhood will recognise any such difference as between the titled and the untitled, the wealthy and the poor, those possessed of power and those who have no other sway but o'er themselves. When the stripling who has very rightly shown a respectful demeanour towards his seniors becomes a man, neither formal courtesy on the one hand, nor rudeness on the other, becomes him. And what is true of individual manhood is true also of the manhood of civilisation, which has not yet, however, been fully reached in any country or among any race either in the old world or in the new.

There is something to be said, after all, in defence, if not in favour of the form of loyalty which Americans, according to Wendell Holmes, so little understand. It is the rudimentary representative in our time of what was once a true and very useful form of loyalty. The ancestors of Baron Bradwardine, for instance, when they showed in council or in field their loyal devotion either to the ruler of Haggisland or to their own immediate chieftain, showed loyalty to their country or their clan. The faithful service, even the personal service, of king or chief, was often in those days equivalent to faithful service in the common cause of all who were led by him. The modern Baron of Bradwardine, Sheriff of the capital city of Haggisland, no warrior but a wizard, with his pen did not present a very dignified scene when he sat upon the goblet from which the royal lips of Brentford's king had drunk wine; nor was there any value for his country in what he thus endured in the royal cause; but the worthless loyalty he thus ingloriously displayed was derived from what had been true loyalty among his predecessors. Being akin to a quality which when it throve best led to deeds of heroism it could not be wholly contemptible; yet could it no more be compared with the valuable loyalty of old days than the boot licking of a modern courtier can be compared with the devotion of a Bayard to his country.

It must be admitted, however, that the loyalty of our times is sometimes hardly saved, even by its remote kinship with true self-sacrificing loyalty—displayed towards a person but in the cause of a people—from becoming absurd, if not contemptible. The mastiff of the fable, whose neck showed the mark of the collar, even when the collar was removed, was not altogether proud of the distinction. Perhaps had he been a lady's spaniel he might have regarded it as a distinction: in that case when the wolf asked what it meant, he might have replied (always providing the wolf had not eaten him up first) that he was proud to wear his mistress's collar, and could therefore have no objection to bear the visible traces it had left on his neck. But then the moral of the fable would have gone more strongly against that spaniel than against Æsop's mastiff. To the latter the wolf simply objected that he preferred liberty and hunger to slavery and a full stomach: he would have answered the spaniel more forcibly.

The moral of the modified fable is not far to seek. Americans who, like Dr. Wendell Holmes, somewhat contemptuously regard the mark of the collar on the British mastiff, may understand from the experience of their own nation, directly sprung from, nay, *made by* the British race bearing such a mark, that it implies no real degradation of character. It is but skin deep, and has been shown again and again to be consistent with faithful courage and steady loyalty of the truest kind. Our British race knows in America, as in the old home—and the nations know—that personal loyalty, though no longer meaning quite what it did of yore, is still very closely akin to true patriotism. But the noisy British yelp of poodledom, just now heard rather too frequently, both in the old country and abroad, is not pleasing to the ears either of native Britons or of the descendants from old Britain here. There must be a strain of savagery, that is, of undeveloped race-manhood, in all races, even the most advanced—even as in the world at large there are still present races akin in all their ways to the Neolithic, even to the Palæolithic races of pleistocene time. But these antiquated types are not the credit but the disgrace of the times which they have unhappily survived.

THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

By Edward Clodd.

PART II.

CHAPTER VII.—SOCIAL EVOLUTION.—(*Concluded.*)

EVOLUTION *of Morals.*—Man by himself is not only unprogressive, he is also unmoral. For where there is no society there is no sin. Therefore the bases of right and wrong lie in conduct towards one's fellows: the moral sense or conscience is the outcome of social relations. The common interests which impel to combination involve praise or blame of the acts of each individual in the degree that they aid or hinder the well-being of all; in other words, add to their pleasure or their pain, and this praise and blame constitute the moral code, the collective or *tribal conscience.* Society, like the units of which it is made up, has to fight for its life, and all primitive laws are laws of self-preservation. Self-preservation is based on sympathy between the several members, and it is therefore the ultimate foundation of the moral sense; whatever is helpful to it is *right,* whatever is a hindrance to it is *wrong.* Although union involves limitation and restraint, so that the units can no longer do exactly as they like, self-interest comes into play, since a man best insured respect for his own rights by respecting the rights of others. Society is not possible where a man is not true to his fellow; there is, as the phrase goes, honour among thieves, probably even among savages as low as the Jolas of Gambia, every one of whom does as he likes, the most successful thief being the greatest man. In that model of sound and clear reasoning, so refreshing a contrast to the tedious word-mongering of most writers on ethics, Darwin's chapter on the growth of the moral sense, he points out how man's instinctive sympathy would lead him to value highly the approval of his fellows, and how his actions would be determined in a high degree by their expressed wishes; unfortunately, often by his own selfish desires. But while the lower instincts, as hunger, passion, and thirst for vengeance, are strong, they are not so enduring or satisfying as the higher feelings which crave for society and sympathy. And the yielding to the lower, however gratifying for the moment, would be followed by the feeling of regret that he had thus given way, and by resolve to act differently for the future. Thus at last man comes to feel through acquired and perhaps inherited habit that it is best for him to obey his more persistent impulses.* It is this self-accusing feeling of remorse (literally, *biting again*), due to power of reflection on actions and motives, which makes the difference so profound between man and the lower animals, whose moral sense does not advance beyond the stage which commits or avoids certain acts according as they are remembered as pleasurable or painful to the creature itself.

* "Descent of Man," chap. iv.

Special value would be set by the tribe upon brave and unselfish acts as contributing to the commonweal; praise and honour would reward the doer, encouraging that love of the tribe in which lay the germ of love of country. For he who is not a good citizen cannot be a true patriot, and he who holds not his fatherland dear can never become a well-wisher to mankind. The conceptions which these larger interests involve are, however, of very slow growth; for a long time the feeling of rightness and wrongness was limited to acts harmful or helpful to the tribe; in fact, that which was a crime within its borders became a virtue, and even a duty, outside them. What Cæsar says of the ancient Germans—"Robberies beyond the bounds of each community have no infamy, but are commended as a means of exercising youth and lessening sloth"*—still applies to barbaric peoples, and has its survival in the slowly-decaying prejudices of civilised nations.

Morals are relative, not absolute; there is no fixed standard of right and wrong by which the actions of all men throughout all time are measured. The moral code advances with the progress of the race; conscience is a growth. That which society in rude stages of culture approves, it condemns at later and more refined stages, although such is the power of custom in investing the old with sanctity, such the persistence of authority and so deep its interest against change, that moral qualities are grafted upon acts apart from any question of their bearing upon character. Such, for example, are the prohibitions against certain foods and the commands to keep certain days sacred; such also the tyranny of caste, as among the Bhattias of India, who regard dining at an hotel as a greater sin than murder. Among the Mohammadan sect of the Wahhabees murder and adultery are venial offences compared to the smoking of tobacco. Among many savage peoples it is worse to marry a girl within the tribe than to murder one of another tribe. Among ourselves society condones a seduction, but not a *mésalliance*, and forgives an offence against etiquette less readily than an act of dishonour.

The alterations in criminal codes witness to progress in morals. Not to go further back when laws punishing heresy and witchcraft were in force; within the present century, people were burned to death for coining false money, hanged for stealing a few shillingsworth of goods, and imprisoned for paltry debts, death being often the only bringer of release. Among the sights of London were the procession of condemned criminals to Tyburn every six weeks, and the auctions of negroes at the Poultry Compter. These and a hundred other barbarities went on without protest from the humane, whether Christians or non-Christians, for the collective conscience did not question their rightness, and their abolition was ultimately due to the efforts of individuals in whom a higher sense of human rights and duties was aroused, and through whom the general moral tone was advanced. That heightened tone, which is a yet stronger note of our time, is, in the main, due to the progress of science, using the term as including not merely knowledge of the operations of nature, but knowledge of human life as affected by divers causes, and of the community of blood of all mankind.

It is this which has broken down the barriers of prejudice between the classes of each nation and between nations themselves, bringing home the force of the Italian proverb, "tutto il mondo è paese"—"all the world is one country."

* "Comm.," book vi, chap. 23.

This larger view extends the range of human sympathy and of the service of man to his fellows, as well as to the lower animals, which that sympathy inspires. Terrible are the ills which the misuse of knowledge in the hands of the selfish and the ruffian inflicts, but these are as dust in the balance against the good which has been wrought. The conduct of a nation is no longer regulated solely by its own interests without regard to what is due to others, neither does it draw its sanction from the tribal legislation of a barbaric past, but from what, after ages of dearly-bought experience, has proved itself to be best for man. In this, as in aught else which endures, nothing is rigid or final. Man's capacity can never overtake his loftiest ideals, although in their conception is the spur to their pursuit. What dead weight of care do morals, thus regarded, lift from the heart of man—what new energy is given to his efforts! Thought becomes fixed on the evolution of goodness instead of on the origin of evil; time is set free from useless speculation for profitable action; evils once deemed inherent in the nature of things, and therefore irremovable, are accounted for and shown to be within his power to extirpate.

In proving the unvarying relation between cause and effect in morals as in physics, science gives the clue to the remedy for moral ills. Moreover, that which man calls sin is shown to be more often due to his imperfect sense of the true proportion of things, and to his lack of imagination, than to his wilfulness; "evil is wrought by want of thought as well as want of heart." As Herbert Spencer says, "feelings, not ideas, govern the world," and the lack of imagination, which is itself largely due to defective training of the intellect, prevents a man from putting himself in the place of others, and deprives him of that sympathy which is essential to the unselfish life. The terrible mass of wrongdoing can only be lessened and finally removed by suppression of the over-self; by the maintenance of the balance between such care of one's self as shall best fit us for the service of man, and such thought for others as shall inflict on them no suffering through our selfishness, nor loss through our gain.* The crises of history are now rare when great principles or causes, demanding the sacrifice of the individual life, are at stake, but the world has never lacked a Curtius, and the spread of the scientific spirit has not proved fatal to the heroic.

Especially is science a preacher of righteousness in making clear the indissoluble unity between all life past, present, and to come. We are only on the threshold of knowledge as to the vast significance of the doctrine of heredity, but we know enough to deepen our sense of debt to the past and of duty to the future. We are what our forefathers made us, *plus* the action of circumstances on ourselves, and in like manner our children inherit the good and evil, both of body and mind, that is in us. Upon us, therefore, rests the duty of the cultivation of the best and of the suppression of the worst, so that the future of the race suffers not at our hands. More imperious is that duty, since nothing—not omnipotence itself—can step in between us and the consequences of our acts. Our sins are sins against our fellow-man: he alone can forgive us, although he cannot cancel their effects. "Our deeds are like the children born to us, they live and act apart from our own will. Nay, children may be strangled, but deeds never." †

Self-conquest lies in obedience, obedience lies in knowledge; and if to know that it rests with man to make or to mar the lives of others be not sufficing stimulus to learning the true that we may do the right, no other motive can avail. Experience shows that the threats of punishment and the promises of a reward in an after-life have the smallest effect on conduct; their remoteness exhausts their power, and, moreover, the belief in them is slowly decaying.

For the conduct of life brief maxims are enough; all the law and commandments are in the golden rule; all ethics in the teaching that if man be true to himself he cannot be false to his fellows; while in the knowledge that life's demands will always exceed its opportunities we may feel

How fair a lot to fill
Is left to each man still.

Evolution of Theology.—Theology may be defined as dealing with man's relations to the god or gods in whom he believes; morals, as dealing with his relations to his fellow-men.

Unfortunately, the two have become a good deal mixed in the degree that conduct has been made to rest on supposed divine commands as to what men shall and shall not do, an assumption which serves a useful purpose as a restraint upon the brutal and ignorant, but which has been a powerful engine of terrorism in the hands of the unscrupulous and fanatical. The confusion, however, disappears when it is seen that the evolution of belief in spiritual beings is a thing apart from the evolution of morals which, as has been shown, are based on social instincts and sympathies guided by reason and strengthened by inheritance and practice. For primitive theology is primitive science; it is the outcome of man's first efforts to explain the nature of his surroundings, and of the divers influences which affect him for good, and, still more, for ill. At this stage of his mental growth the emotions have foremost play, for feeling precedes reason, and its exercise is more easy, its results more rapid, although, on that account, less trustworthy. Moreover, the phenomena on which experience, as the sole guide to true knowledge of things, is based, are too vast for a single life to compass, even were the reasoning faculty capable of dealing with them. It needed the lapse of time ere man found out how his senses tricked him at every turn, and ere he could form any conception of orderly relation in his surroundings. So far as effort to supply his lower needs sharpened his wits, he did not go far astray; in his struggle against material foes the weapons of his warfare were carnal; but as against spiritual powers he was defenceless. Ignorance, always the mother of mystery, made him the slave of his fears. The universal instinct of the savage leads him to ascribe an indwelling life to everything that moves, from the sun in heaven to the rustling leaves, and the stones that roll from the hillside across his path. In this he acts as we see shying horses, timid pups, and young children act, until they learn from experience what things move of their own accord and what things do not. Shakespeare might have added Caliban to "the lunatic, the lover, and the poet," as of imagination all compact, and on whom it plays such tricks,

That if it would but apprehend some joy,
It comprehends some bringer of that joy.

Ever on the alert against enemies, man's fancy multiplied them on all sides, and since he naturally attributed passions like his own to the unseen beings in whom he believed, he dreaded "some bringer of that" harm from every quarter. The sun might shine, and the moon brighten the gloom of night, but these were fitful in their coming and their going, the black cloud-monsters swallowed them, and in the wake of storm and lightning, dragons of the fire and the wind, there followed destruction and death. Hence the prominence of devil worship, of belief in baleful powers amongst the lower races, and the averting of their wrath by

* Let me commend to careful study the chapter on "The Cultivation of Human Nature" in Mr. Cotter Morison's recently published "Service of Man."

† "Romola," p. 150.

sacrifices; hence, also, the persistence of like beliefs amongst the illiterate in civilised countries.

This animism, or general doctrine of spiritual agents, was largely fostered by personal experience supplied by dreams about both the dead and living, hallucinations, swoons, and by the shadows or reflections which objects cast, all which seemed to witness to the existence of a second self or soul, that came and went at pleasure during life, and haunted its old spots after death. The burial-place became the spot where the living brought their gifts to the dread spirits of the departed, whose worship is a leading feature of barbaric religions. Combined with the belief in life wherever power or movement were manifest, these elements have built up all theologies from the polytheistic to the so-called monotheistic, the common element in each being the ascription of personality to unseen powers. Given the intellectual stage which a people has reached, the character of their gods can be predicted, although the higher theologies will retain persistent traces of the barbaric conceptions of deity in which they arose. They are not, as shallow carpers have argued, the ingenious inventions of self-seeking men; they arise out of the necessity of human nature to frame an explanation of that which affects it deeply and constantly. Their roots draw nutriment from a common soil; the frenzy of the savage and the ecstasy of the saint have a common base in undisciplined imagination.

Theology is only purified from gross conceptions in the degree that it is purged of the false science with which, to its own hurt, it identified itself in the past, and to the remnants of which it still clings. The function of science is to clarify the mind and to show how the beliefs of the past are the myths of the present; the duty of theology is to readjust itself to what science proves to be true. Creeds may die, rites and ceremonies become matters of archæological interest, but human needs endure. Conduct is everything, because duty never lapses. Theology, uncorrected, troubles itself about the fate of a man who denies its speculative doctrines; morals bid him remember, as the one thing needful, that what he sows he or his will reap.

In the papers now brought to an end a vast field, the limits of which shade into the unlimited on all sides, has been roughly surveyed. We began with the primitive nebula, we end with the highest forms of consciousness; the story of creation is shown to be the unbroken record of the evolution of gas into genius.

Let us epitomise what, after all, is itself but a summary of a large subject:—

I. *Description.*—The universe is made up of Matter and Power, both of which are indestructible. Matter contains about seventy so-called elementary substances, which exist in a free or combined state as solid, liquid, or gaseous; it is also present throughout space in the imponderable state known as ethereal. The motions of Matter are due to Power, which acts in a twofold and opposite way, viz., as a pulling or combining Force, and as a pushing or separating Energy. Force inheres in matter, and acts continuously whatever the distance; Energy is both passive or stored up, and active or in a state of transfer from body to body, the sum-total being in gradual course of transfer to the ethereal medium, where its power to do work ends. Ponderable matter is distributed throughout space in bodies of various size and density, from molecules to sidereal or solar systems. Such a system is our central sun, with his company of planets and their moons and of comets and other wandering bodies. The planet on which we live is a nearly spherical body, three-fourths of which is covered by water, and the whole surface enveloped by an atmosphere. So far as its rind or crust can be examined, it is found to consist of solid rocks, the lowest of which have been fused by fire, and the uppermost laid down by water. The water-laid rocks contain the remains of plants and animals which have escaped the general destruction of organisms in the wear and tear which the rocks undergo ceaselessly. The simplest fossils are found in the oldest deposits, the more advanced in the newer, and so on in ascending scale until we reach the newest deposits, which contain the highest forms (see Table, Knowledge, vol. ix. p. 174). The existing species of plants and animals comprise the lowest and simplest, which have persisted throughout the life-period, and the highest, the vast majority of intermediate species having died out. All plants and animals are made of the same materials and have to do the same work. That work is threefold: to feed, to multiply their kind, and to respond to the outer world. The cells of which every part of every plant and animal is built up are variously altered and arranged according to the way in which that work is more or less divided amongst the several parts. The main difference between plant and animal is in the mode of feeding; the plant is alone able, in virtue of its chlorophyll, to convert the inorganic into the organic, and the animal therefore depends on the plant for its food supply.

II. *Explanation.*—At the beginning of the present universe matter was a diffused vaporous mass, unequally distributed throughout space. Force, acting on the unstableness of that mass, drew its particles together, and the resulting collision set free the stored-up energy, which became active in two forms: the *molar*, causing the several masses into which the particles had gathered to spin round in an orbit, and the *molecular*, causing a swinglike motion among the particles, which motion was converted into light and heat. The masses into which the primitive nebula was broken up became sidereal or solar systems, each of which, like the parent mass, threw off, as it was indrawn towards its common centre of gravity, masses which became the planets, from which were detached, in like manner, masses which became moons. Comets and other fugitive bodies are probably due to expulsion. Both in its shape and general condition the earth gives proof of this passage from the gaseous to the solid state. As one of the smaller bodies, it long ago ceased to shine by its own light, but a vast period elapsed before it became cool enough to form a crust and condense the vapours that swathed it into primeval oceans. The simplest compounds of its elements were formed first, the combinations becoming more and more complex until they reached that subtile form which is the physical basis of life, and which, starting as a structureless jelly, has reached its fullest development in man. The organic is dependent upon the inorganic, and mind, as a special form of life, takes its place as the highest product of the action of Power upon Matter. From the action of mind on mind has arisen that social evolution to which, in a supreme degree, is owing the progress of man in knowledge, whereby he has subdued the earth.

The ultimate passage of all energy to the ethereal medium involves the end of the existing state of things. But the ceaseless redistribution of matter, force-clasped and energy-riven, involves the beginning of another state of things. So the changes are rung on evolution and dissolution, on the birth and death of stellar systems—gas to solid, solid to gas, yet never quite the same—mighty rhythmic beats of which the earth's cycles, and the cradles and graves of her children, are minor rhythms.

. . . .

Thus the keynotes of Evolution are unity and continuity. All things are made of the same stuff differently mixed, bound by one force, stirred by one energy in divers forms. Force inheres in matter; Energy acts through it; therefore both have neither more nor less claim to objective reality than matter. And as science tends to the conclusion that all kinds of matter are modifications of one primal element, and that all modes of motion are varied operations of one power, perchance these three—Matter, Force, and Energy—are one.

But into these and like speculative topics Evolution does not intrude. Dealing with processes, and not with the nature of things in themselves, it is silent concerning any theories that may be formulated to gratify man's insatiate curiosity about the whence and whither. And since it can throw no light on the genesis of matter, or on the origination of motion, or on the beginnings of life or of mind, it leaves great and small alike a centre of impenetrable mystery. It may correct, yet it does not curb, the imagination; it has no shibboleths the surrender of which can awaken dread; its temper is not aggressive, it seeks to inform the life with the love of truth, and to let the facts which it reveals win their way on their own merits; since "a dogma learned is only a new error—the old one was perhaps as good; whereas a spirit communicated is a perpetual possession." Our sense of the beauty of nature is not dimmed by fuller and truer knowledge of her works and ways, while all that it really suffices us to know for the discharge of life's duties, and all the motive that is needed to impel us thereto, is supplied in the theory which has so profoundly and permanently affected every department of human thought.

NOTE.—After the needful revision incident to their serial issue, these papers will be published, with illustrations, in book form.

THE CIVIL WAR IN AMERICA.*

CONSIDERING that the fighting tendencies of man are among his least noble qualities, and are certainly those most obviously suggestive of his descent through savage ancestors from brute progenitors, there is something painfully suggestive in the tone in which the writer of the following matter glorifies the biggest but most senseless war the world has yet known. Had the North really fought, as has been pretended in the face of all the facts, to free the slave, and had that cause been as good as the liberty-loving Englishman is apt to believe, the whole of the South would have been degraded by their share in the war, and the United States could not have felt free of the shame thus falling on a most important section of the nation. As a mere matter of fact, however, the war only indirectly depended on the question of slavery, the differences really at issue being political, and, in the main, most unworthy of the sacrifices made on both sides during the four years of fighting. As for the slavery of the coloured people, there were, undoubtedly, shameful abuses in the system, and these North and South were alike bound in duty to remove. But no one who has ever lived among the coloured people can doubt for a moment that general emancipation came a great deal too soon. The race was and is utterly unfit for independence within any civilised community, however fully entitled to the freedom of savagery in the countries from which they were wrongfully stolen. Freeing them *en masse* was about as wise as turning loose all our domestic animals would be. Giving them the franchise was simply madness. Meant, however, as a deadly insult to the defeated Southerners, it has enabled them (showing in this characteristic cleverness) to get the dead weight of numbers they before wanted, the whole black vote going now (practically) with the former masters of the coloured race.

* The quoted matter is from the *Cincinnati Commercial Gazette*.

"Official returns show that about 2,653,000 soldiers enlisted during the war in response to the successive calls of President Lincoln, and that of this number 186,097 were coloured troops.

"Reports show that the Northern and Southern armies met in over two thousand skirmishes and battles. In 148 of these conflicts the loss on the Federal side was over 500 men, and in at least ten battles over 10,000 men were reported lost on each side. The appended table shows that the combined losses of the Federal and Confederate forces in killed, wounded, and missing in the following engagements were:—

"Shiloh, 24,000; Antietam, 18,000; Stone River, 22,000; Chickamauga, 33,000; McClellan's Peninsula campaign, 50,000; Grant's Peninsula campaign, 140,000; and Sherman's campaign, 80,000.

"Official statistics show that of the 2,653,000 men enlisted, there were killed in battle 44,238; died of wounds, 49,205; died of disease, 186,216; died of unknown causes, 24,184; total, 303,843. This includes only those whose death while in the army had been actually proved. To this number should be added, first, 26,000 men who are known to have died while in the hands of the enemy as prisoners of war, and many others in the same manner whose deaths are unrecorded; second, a fair percentage of the 205,794 men who are put down on the official reports as deserters and missing in action, for those who participated in the war know that men frequently disappear who, it was certain, had not deserted, yet could not be otherwise officially accounted for; third, thousands who are buried in private cemeteries all over the North who died while at home on furlough.

"The dead are buried in seventy-three National cemeteries, of which only twelve are in the Northern States. Amongst the principal ones in the North are Cypress Hill, with its 3,786 dead; Finn's Point, N.J., which contains the remains of 2,644 unknown dead; Gettysburg, Pa., with its 1,967 known and 1,608 unknown dead; Mound City, Ill., with 2,505 known and 2,721 unknown graves; Philadelphia, with 1,909 dead; and Woodlawn, Elmira, N.Y., with its 3,900 dead.

"In the South, near the scenes of terrible conflicts, are located the largest depositories of the slain:—Arlington, Va., 16,264, of which 4,319 are unknown; Beaufort, S.C., 9,241, of which 4,493 are unknown; Chalmettee, La., 12,511, of which 5,674 are unknown; Chattanooga, Tenn., 12,962, of which 4,963 are unknown; Fredericksburg, Va., 15,257, of which 12,770 are unknown; Jefferson Barracks, Mo., 11,490, of which 2,900 are unknown; Little Rock, Ark., 5,602, of which 2,337 are unknown; City Point, Va., 5,122, of which 1,374 are unknown; Marietta, Ga., 10,151, of which 2,963 are unknown; Memphis, Tenn., 13,997, of which 8,817 are unknown; Nashville, Tenn., 16,526, of which 4,700 are unknown; Poplar Grove, Va., 6,190, of which 4,001 are unknown; Richmond, V., 6,542, of which 5,700 are unknown; Salisbury, N.C., 12,126, of which 12,032 are unknown; Stone River, Tenn., 5,602, of which 288 are unknown; Vicksburg, Miss., 16,600, of which 12,704 are unknown; Antietam, Va., 4,671, of which 1,818 are unknown; Winchester, Va., 4,559, of which 2,365 are unknown.

"In all, the remains of 300,000 men who fought for the stars and stripes find guarded graves in our national cemeteries. Two cemeteries are mainly devoted to the men who perished in the prisons of the same name—Andersonville, Ga., which contains 13,714 graves, and Salisbury, with its 12,126 dead, among which 12,032 are unknown.

"Of the vast number who are interred in our national cemeteries, 275,000 sleep beneath the soil of the Southern

States, and 145,000 of these rest in graves marked unknown.

"The total Confederate loss will never be known, but the best estimates place it at about 220,000 men out of 1,000,000 men who served in the Southern armies. They fought during the war on the defensive, among friends, and generally under cover of breastworks of one kind or another, from rifle-pits to regular fortifications, which gave them an enormous advantage.

"The total number of men furnished to the Federal army by the United States during the war under all calls was 2,683,523. The total number of coloured troops in the Northern army was 123,156. The heaviest loss by disease was suffered by the coloured troops; while but 2,897 died in action and of wounds, the enormously large number of 26,301 died of disease. Among the white troops the proportion of deaths in action and from wounds to the deaths from disease was about 1 to 2; among the coloured troops as 1 to 8. Of the coloured troops enlisted, one out of every seven died of disease. The proportion among the white troops was 1 to 15.

"Now that we are brushing up these figures it will be well enough to remember how many men were furnished by each State, and the following list will show:—

Maine	71,715	Ohio	317,133
New Hampshire	34,605	Indiana	195,147
Vermont	35,256	Illinois	258,217
Massachusetts	151,785	Michigan	90,119
Rhode Island	24,711	Wisconsin	96,118
Connecticut	52,270	Minnesota	25,024
New York	455,568	Iowa	75,860
New Jersey	79,511	Missouri	108,778
Pennsylvania	366,326	Kentucky	78,546
Delaware	13,651	Kansas	20,097
Maryland	49,730		
West Virginia	30,003	Total	2,653,062
District of Columbia	16,872		

"Few of the great battles of history can compare in magnitude with the greatest battles of the Civil War, and the battles of that war were the bloodiest in all the history of wars in the proportion of killed to those engaged. Waterloo was one of the most desperate and bloody fields chronicled in European history, and yet Wellington's casualties were less than 12 per cent., his losses being 2,432 killed and 9,580 wounded out of over 75,000 men, while at Shiloh one side lost in killed and wounded 9,740 out of 34,000, while their opponents report their killed and wounded at 9,616, making the casualties about 30 per cent. At the great battle of Wagram, Napoleon lost but about 5 per cent. At Würzburg the French lost but $3\frac{1}{2}$ per cent., and yet the army gave up the field and retreated to the Rhine.

"At Zurich, Massena lost but 8 per cent. At Malplaquet, Marlborough lost but 10 per cent., and at Ramillies the same intrepid commander lost but 6 per cent.

"At Contras, Henry of Navarre was reported as cut to pieces, yet his loss was less than 10 per cent. At Lodi, Napoleon lost $1\frac{1}{4}$ per cent. At Valmy, Frederick William lost but 3 per cent.; and at the great battles of Marengo and Austerlitz, sanguinary as they were, Napoleon lost an average of less than $14\frac{1}{2}$ per cent. At Magenta and Solferino, in 1859, the average loss of both armies was less than 9 per cent. At Königgratz, in 1866, it was 6 per cent. At Werth, Spicheren, Mars la Tour, Gravelotte, and Sedan, in 1870, the average loss was 12 per cent., while at Linden General Moreau lost but 4 per cent. and the Archduke John lost but 7 per cent. in killed and wounded. Americans would scarcely call this a lively skirmish.

"At Perryville, Murfreesboro, Chickamauga, Atlanta, Gettysburg, Mission Ridge, the Wildernesses, and Spottsylvania, the loss frequently reached, and sometimes exceeded, 40 per cent., and the average of killed and wounded on one side or the other was over 30 per cent.

"Of the gentlemen who were at West Point during one period of a cadetship, fifty-six were killed in battle, and, estimating the rate of killed and wounded at one to five, 280 were wounded.

"From the discovery of America to 1861 in all wars with other nations the record gives the deaths in battle of but ten American generals, while from 1861 to 1865, both sides being opposed by Americans, more than 100 general officers fell while leading their columns. From 1492 to 1861 the killed and wounded upon American soil in all battles, combats, and skirmishes, added together, as shown by reports, hardly exceeded the casualties of single battles of the great American conflict."

SHAKESPEARE'S SONNETS.

I PROMISED some time back (or threatened—which is it?) to show from Shakespeare's sonnets that the special forms of knowledge traceable in the writer of the plays can be recognised in poems unquestionably by Shakespeare. I now propose to carry out this idea.

I take first the tokens of legal knowledge, or rather the use of legal terms and expressions so correctly that many lawyers have wondered how the country-bred Shakespeare could have obtained such command of legal language. Of course the wonder is not so great as many imagine. It is quite true that most of our best novelists blunder when they deal with legal matters, and especially when they try to use legal phraseology. But that is natural enough. The novelist is no more likely to have occasion, in his own experience, to study even the simplest legal questions, than other folk; and almost every reader of these lines who is not himself a lawyer knows how unapt he would be in the use of legal phraseology. But if any one not a lawyer has occasion, unfortunately for himself, to have dealings with lawyers, and if he has been careful to master all such legal statements as those dealings bring before him—then he will very soon acquire readiness and precision in the use of law terms, especially if he is observant and has a good memory. Now Shakespeare, owing to the many troubles in which his father was involved, had probably occasion to hear a great deal about legal matters; we can hardly suppose that a man of his power (judging only by the poems) would let these matters pass unnoticed. His keenness of observation and insight into meanings would enable him very quickly to learn all those details to which every sensible man who has dealings with the law must attend, and we have only to consider Shakespeare's amazing facility of expression to know that none could be quicker than he would be in seizing the meaning of new terms and phrases, and turning them into account in his poetry.

The trouble in this matter lies in the selection, so numerous throughout the sonnets are the legal terms and phrases. They come in sometimes casually, but not less significantly from the beginning. Thus, after touching in the first three sonnets on heirship, succession, posterity, and so forth, in the fourth sonnet Shakespeare deals with these and associated ideas in terms which might be objected to by an overwise critic as unduly technical. "Unthrifty loveliness," he says,—

. . . . why dost thou spend
Upon thyself thy beauty's *legacy*?
Nature's *bequest* gives nothing, but doth lend,
And being frank, she lends to those are free;

Then, beauteous niggard, why dost thou abuse
The bounteous *largess* given thee to give!
Profitless *usurer*, why dost thou use
So great a *sum* of *sums*, yet canst not live?
For, having *traffic* with thyself alone,
Thou of thyself thy sweet self doth deceive,
Then how, when nature calls thee to begone,
What acceptable *audit* canst thou leave?
Thy unus'd beauty must be tomb'd with thee,
Which, us'd, lives thy *executor* to be.

[Here also the words "us'd" and "unus'd" are used in their legal sense, as relating to the usance of money.]

So, again, only a little further on (and it is worth noticing that these earlier sonnets were written when Shakespeare was a very young man), we find the hope expressed that "beauty held in *lease*" may "find no *determination*":—

Then you were
Yourself again, after yourself's *decease*,
When your sweet *issue* your sweet form should bear.

And so, passing on, we find again and again the terms and phrases of law brought in so naturally and so correctly that one might be tempted to say that Shakespeare's vocabulary borrowed too much from legal phraseology, did one not notice that scarcely any other subject can be named from which he has not in like manner borrowed. But we also find sonnets in which not casually, but evidently of set purpose, legal imagery (if one may use such an expression) is employed throughout. Consider, for instance, the following (Sonnet 46), in which a case in equity is fairly tried, though for poetic convenience the trial is called first a "war":—

Mine eye and heart are at a mortal war,
How to divide the conquest of thy sight;
Mine eye my heart thy picture's right would *bar*,
My heart mine eye the *freedom* of that *right*.
My heart doth *plead* that thou in him dost lie—
(A closet never pierc'd with crystal eyes),
But the *defendant* doth that *plea* deny,
And says—in him the fair appearance lies.
To 'cide this *title* is *impanelled*
A *quest* of thoughts, all *tenants* to the heart,
And by their *verdict* is *determined*
The clear eye's *moiety* and the dear heart's *part*:
As thus—mine eye's *due* is thine outward part,
And my heart's *right* thine inward love of heart.

Sonnet 87 is still more strikingly legal in tone, and should be carefully studied by the believers in the Baconian theory of Shakespeare's plays, as showing them at least that if legal phraseology, correctly employed, proves Bacon the author of the plays, it proves Bacon to be the author of the sonnets also: and in that case the Baconians will have to explain what Bacon meant by saying in the sonnets (written when Bacon stood already before the world a model of sober manhood devoted to most dignified employment) that he had "made himself a motley to the view." The sonnet runs—

Farewell! thou art too dear for my *possessing*,
And like enough thou know'st thy *estimate*:
The *charter* of thy worth gives thee *releasing*;
My *bonds* in thee are all *determinate*.
For how do I hold thee but by thy *granting*?
And for that riches where is my deserving?
The cause of this fair gift in me is wanting,
And so my *patent* back again is *swerving*.
Thyself thou gav'st, thy own worth then not knowing,
Or me, to whom thou gav'st it, else mistaking:
So thy great gift, upon *misprision* growing,
Comes home again on better *judgment-making*.
Thus have I had thee, as a dream doth flatter,
In sleep a king, but waking, no such matter.

In Sonnet 134 we not only note the use of many legal phrases, but we also seem to recognise some suggestion of unpleasant recollections of those home difficulties which, as we know, troubled Shakespeare's father. It runs:—

So now have I confessed that he is thine,
And I myself am *mortgaged* to thy will,
Myself I'll *forfeit*, so that other mine
Thou wilt *restore*, to be my comfort still;
But thou wilt not, nor he will not be free,
For thou art covetous and he is kind;
He learn'd but *surety-like*, to *write* for me,
Under that bond that him as fast doth bind,
The *statute* of thy beauty thou wilt *take*,
Thou *usurer*, that put'st forth all to *use*,
And *sue* a friend came *debtor* for my sake,
So him I lose through my unkind abuse.
Him have I lost: thou hast both him and me;
He pays the whole, and yet am I not free.

Surely, by the way, no one but Shakespeare could successfully have brought into poetry such legal expressions as "underwriting a bond," "taking benefit of the statute," to say nothing of such legal terms as "mortgaged," "forfeit," and "surety," here, and elsewhere in the sonnets, "debarred," "separable," "arrest,"* "bail," "vassalage," and the like. To Shakespeare even law, medicine, and chemistry had their poetical aspects. He who could find "tongues in the trees, books in the running brooks, and sermons in stones," could find also "good in everything."

We may conveniently turn next to those chemical touches in the plays which (because Lord Bacon dealt with chemistry) have been regarded as suggesting that Shakespeare was the great Lord Chancellor's *alter ego*. Chemical terms are as freely used as legal ones in the sonnets. In sonnets five and six we have a striking example, because a chemical process not seemingly poetical in itself is made poetically useful in most ingenious fashion. The poet, after speaking of beauty's winter, goes on to say:—

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 no remembrance what it was.
But flowers distill'd, though they with winter meet,
Leese but their show, their substance still lives sweet,
Then let not winter's ragged hand deface
In thee thy summer, ere thou be distilled;
Make sweet some phial; treasure thou some place
With beauty's treasure, ere it be self-killed.

Of the astronomy and astrology of his day Shakespeare evidently had what was considered ample knowledge—the Shakespeare of the sonnets had certainly the same ideas on these subjects as the Shakespeare of the plays, though it may here be frankly admitted that Bacon knew more than either, especially in regard to technical terms. In Sonnet 14, Shakespeare says:—

Not from the stars do I my judgment pluck;
And yet methinks I have astronomy,
But not to tell of good or evil luck,
Of plagues, of dearths, or season's quality;
Nor can I fortune to brief minutes tell,
Pointing to each his thunder, rain, and wind,
Or say with princes if it shall go well,
By oft predict that I in heaven find.

It is evident Shakespeare rather doubted the trustworthiness of the Raphaels and Zadkiels of his day. Yet had he some faith in the influences of the heavenly bodies. For he writes in Sonnet 15:—

When I consider everything that grows
Holds in perfection but a little moment,
That this huge state presenteth naught but shows
Whereon the stars in secret influence comment.

* It has been objected by some one, I forget whom, that only a man of legal turn of mind would ever have made Hamlet say "this fell *sergeant*, Death, is strict in his *arrest*." But in Sonnet 79, Shakespeare, speaking of his own death, says:—

When that fell *arrest*
Without all *bail* shall carry me away.

In Sonnet 26, he expresses the hope that some good conceit of the person addressed (whoever he may have been), may bestow the poet's duty in his soul's thought (whatever that may mean)—

> Till whatsoever star that guides my moving,
> Points on me graciously with fair aspect.

In the preceding sonnet he had spoken of "those who are in favour with their stars." Throughout, as throughout the plays, there is a general yet half-doubting acceptance of astrological ideas, but nowhere any reference to such ideas as Bacon advanced in what he called a system of rational astrology.

Among references to painting, I note especially those in Sonnet 24:—

> Mine eye hath play'd the painter, and hath stell'd
> Thy beauty's form in *table* of my heart;
> My body is the *frame* wherein 't is held,
> And *perspective* it is best painter's art
> And through the painter must you see his skill.

(The play on words here is very curious—you are to see through the painter the painter's skill, because perspective or through-seeing is the best art of the painter):—

> To find where your true *image* pictured lies,
> Which in my bosom's *shop* is *hanging* still,
> That hath his windows *glazed* with thine eyes.
> Now see what good turn eyes for eyes have done;
> Mine eyes have drawn thy shape, and thine for me
> Are windows to my breast, where-through the sun
> Delights to peep, to gaze therein on thee;
> Yet eyes this cunning want to grace their art,
> They draw but what they see, know not the heart.

This artificial style is certainly not Shakespeare's best, and is found only in the earlier plays. Yet in "King John" we find a passage which may be compared with Sonnet 24, where Lewis says of Blanche:—

> In her eye I find
> A wonder or a wondrous miracle,
> The shadow of myself formed in her eye;
> Which being but the shadow of your son,
> Becomes a sun and makes your son a shadow;
> I do protest I never lov'd myself
> Till now infixed I beheld myself
> Drawn in the flattering table of her eye.

It is to be noted, however, that Shakespeare *means* this to be taken as poor nonsense; for Falconbridge forthwith, with hearty scorn, laughs it all to the winds. Echoing the Dauphin's folly, he says:—

> Drawn in the flattering table of her eye,
> Hang'd in the frowning wrinkle of her brow;
> And quarter'd in her heart! he doth espy
> Himself love's traitor; this is pity now,
> That hang'd and drawn and quarter'd there should be
> In such a love so vile a lout as he.

How prettily, in Sonnet 128, Shakespeare brings music to his aid in appealing to his mistress for her love:—

> How oft, when thou my music play'st,
> Upon that blessed wood whose motion sounds
> With thy sweet fingers when thou gently sway'st
> The wiry concord that mine ear confounds,
> Do I envy those *jacks* that nimbly leap
> To kiss the tender inward of thine hand,
> Whilst my poor lips that should that harvest reap,
> At the wood's boldness by thee blushing stand!
> To be so tickled, they would change their state
> And situation with those dancing chips,
> O'er whom thy fingers walk with gentle gait,
> Making dead wood more bless'd than living lips.
> Since saucy jacks so happy are in this,
> Give them thy fingers, me thy lips to kiss.

I have not space to quote or even to mention Shakespeare's repeated references throughout the sonnets to flower and field, sowing and reaping, summer and winter, and the ways and works of those who till the soil. But I would specially recommend Sonnets 98 and 99 to those who, having noted how such matters are dealt with in the plays, and that Bacon, after his colder manner, knew much and thought much of flowers and gardens, fondly imagine that Bacon therefore wrote the plays. They run thus:—

> From you have I been absent in the spring,
> When proud-pied April, dress'd in all his trim,
> Hath put a spirit of youth in everything,
> That heavy Saturn laugh'd and leap'd with him.
> Yet nor the lays of birds, nor the sweet smell
> Of different flowers in odour and in hue,
> Could make me any summer's story tell,
> Or from their proud lap pluck them where they grew;
> Nor did I wonder at the lily's white,
> Nor praise the deep vermilion in the rose;
> They were but sweet, but figures of delight,
> Drawn after you, you pattern of all those.
> Yet seem'd it winter still, and, you away,
> As with your shadow I with these did play.
>
> The forward violet thus did I chide:
> Sweet thief, whence didst thou steal thy sweet that smells,
> If not from my love's breath? The purple pride,
> Which on thy soft cheek for complexion dwells,
> In my love's veins thou hast too grossly dy'd.
> The lily I condemned for thy hand,
> And buds of marjoram had stol'n thy hair;
> The roses fearfully on thorns did stand,
> One blushing shame, another white despair;
> A third, nor red nor white, had stol'n of both,
> And to his robbery, had annex'd thy breath;
> But, for his theft, in pride of all his growth,
> A vengeful canker eat him up to death.
> More flowers I noted, yet I none could see
> But sweet or colour it had stol'n from thee.

If the same poet wrote not these lines who conceived the exquisite poetry of Perdita's thoughts on flowers in "The Winter's Tale" (act iv. sc. 3), then can no poet—Homer or Virgil, Dante or Milton, Chaucer or Spenser, Goethe, Schiller, Corneille, or Hugo—be known by his style or power.

And now to show surely that Shakespeare wrote the sonnets, or that at least Francis Bacon did not (and no William Bacon has yet been suggested as the real Shakespeare), let the last lines of Sonnet 136 be quoted here at the last. It might be taken even as an appeal to the doubting Baconian:—

> Though in thy stores' account I one must be,
> For nothing hold me, so it please thee hold
> That nothing me, a something sweet to thee:
> *Make but my name thy love, and love that still,*
> *And then thou lovest me, for my name is* Will.

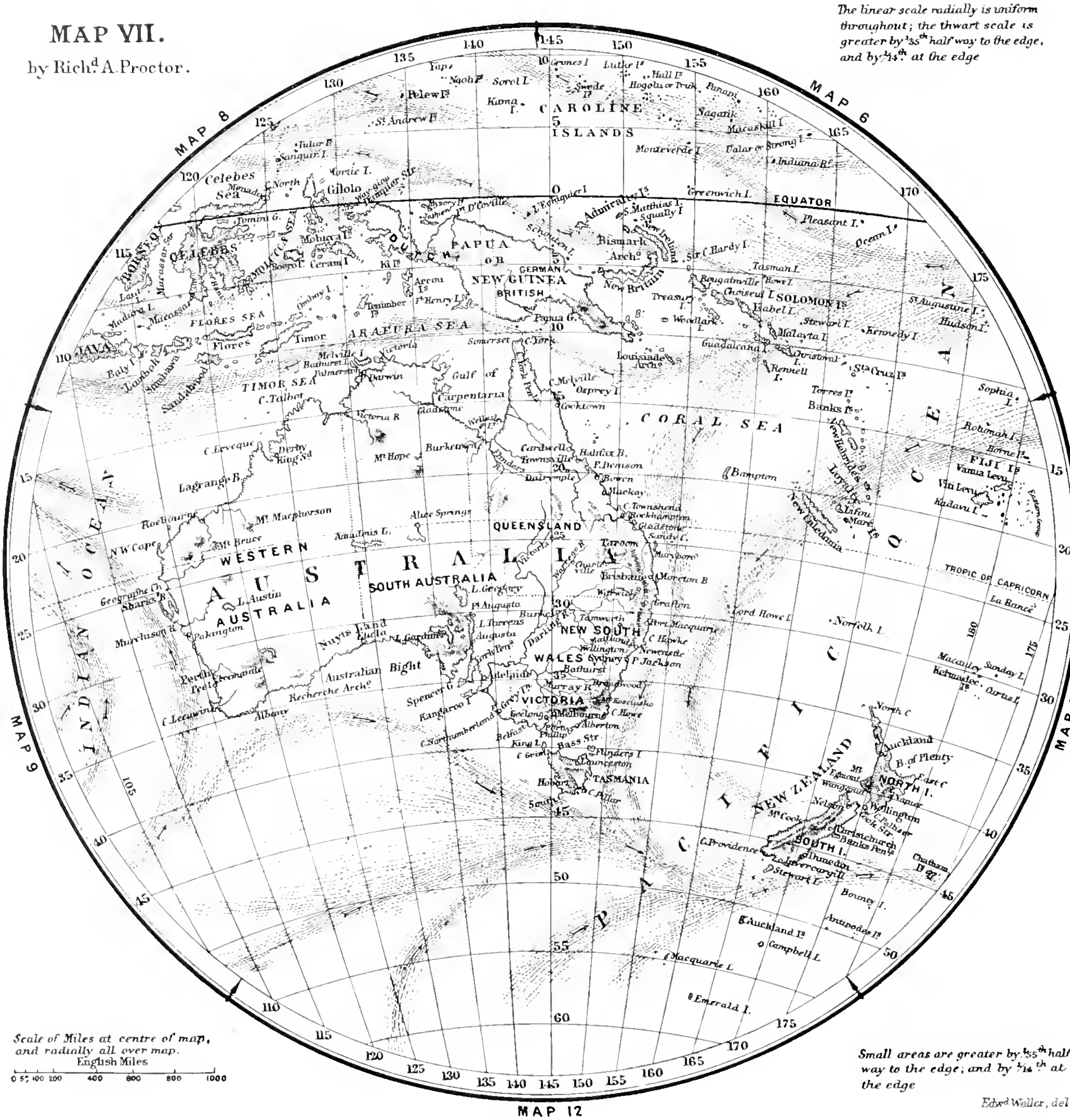
The Mullein Test in Consumption.—The success attending the treatment of consumption with mullein leaves by Dr. Quinlan, of Dublin, and which has been so widely published, has led him to make a formulated statement, showing briefly that in the earlier and pretubercular stage of pulmonary consumption, mullein has a weight-increasing and curative power greater than that of cod liver oil and equal to that of Russian koumiss; in cases where tubercles are well established or cavities exist, the mullein has great power in relieving cough; phthisical diarrhœa is completely obviated by the mullein; but it has no power or effect on the night-sweats of consumption, which are to be combated by atropia sulphate. Three ounces of the fresh green leaves, or about ten times as much of the dried, are boiled in a pint of fresh cow's milk, and after boiling a moment, the infusion is allowed to stand and "sipe" for ten minutes, when it is strained, sweetened and drunk while warm; this quantity is taken twice or three times a day. It is generally much relished by the patients, who regard it as a pleasant article of diet rather than as a medicine. The smoke of these leaves, inhaled into the respiratory passages, relieves irritation and spasmodic cough.

THE ONE-SCALE ATLAS.

MAP VII.

by Richd A. Proctor.

The linear scale radially is uniform throughout; the thwart scale is greater by 1/35th half way to the edge, and by 1/14th at the edge



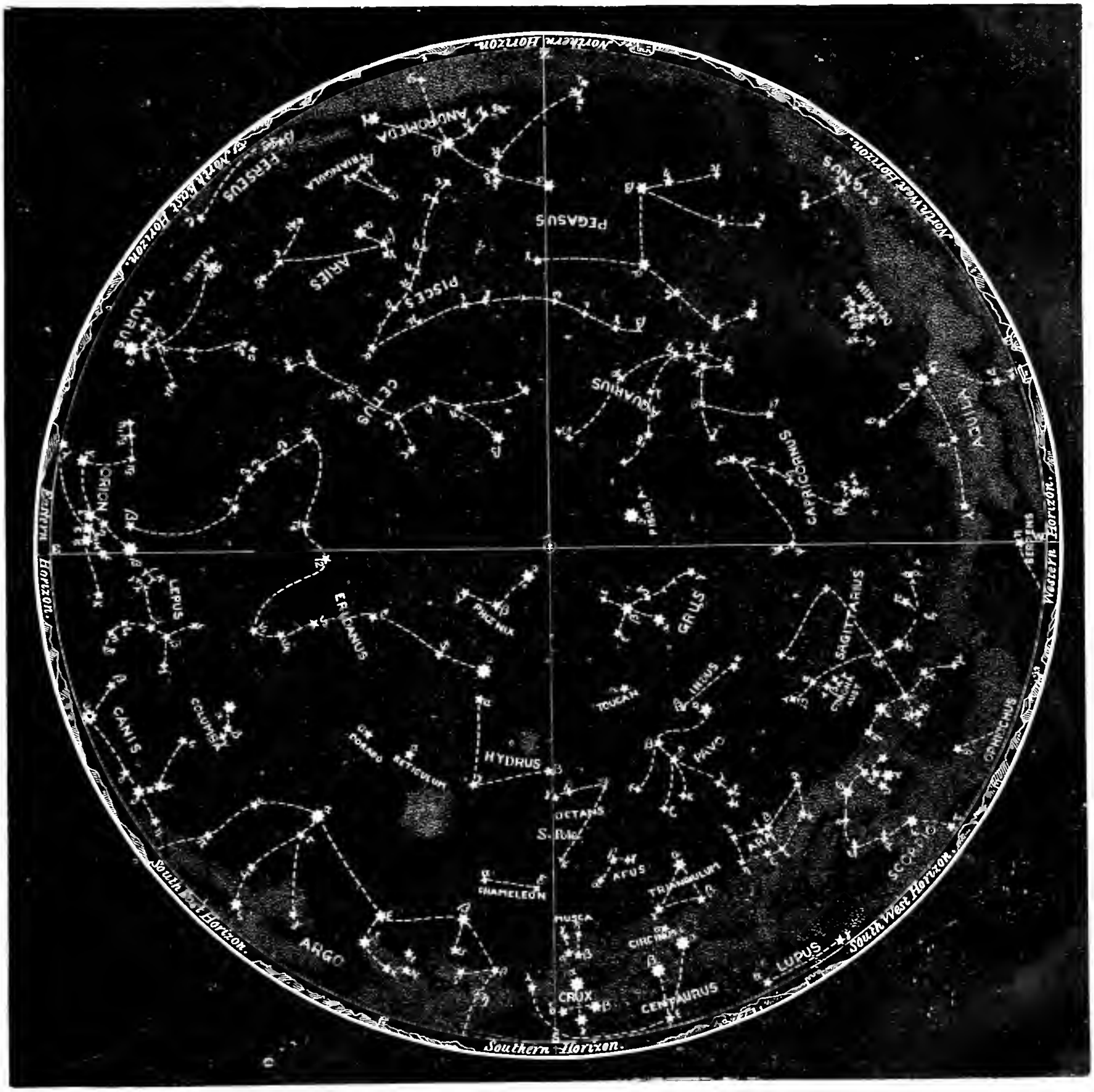
Scale of Miles at centre of map, and radially all over map.
English Miles
0 50 100 200 400 600 800 1000

Small areas are greater by 1/35th half way to the edge; and by 1/14th at the edge

Edwd Weller, del

THE SOUTHERN SKIES.

MAP XI.—For August, September, and October.



The Night Skies in the Southern Hemisphere (Lat. 46° to 24° S.)
and the
Southern Skies in England (Upper Half of Map only) at the following Times:

At 1 o'clock, morning, Sept. 6.	At 11 o'clock, night, Oct. 7.	At 9 o'clock, night, Nov. 7.
„ 12.30 „ „ Sept. 14.	„ 10.30 „ „ Oct. 15.	„ 8.30 „ „ Nov. 14.
„ Midnight, Sept. 21.	„ 10 „ „ Oct. 22.	„ 8 „ „ Nov. 22.
„ 11.30 o'clock, night, Sept. 29.	„ 9.30 „ „ Oct. 30.	„ 7.30 „ „ Nov. 30.

Star Magnitudes.

First . . . . ✸ Second . . . ✶ Third . . . . ★ Fourth . . . . ✦ Fifth . . . ▲

A "PERFECT INNINGS" AT CRICKET: A CHANCE PROBLEM.

DURING the cricket season of 1886 there occurred what has been called a "perfect innings,"* every player on the side scoring double figures, while the extras supplied a twelfth double-figure entry. Not one of the players reached the century, so that when the score of the innings was printed, the numbers opposite the names of the players made a neat double figure column. This has not happened half a dozen times since cricket has been a game. Moreover, the score as actually formed was unique: for every item was above 15 (only one was below 20), and that has never happened before.

In the *Times* there appeared, a few days after this remarkable game between the Australians and an English eleven, a letter in which the exceptional nature of the innings was commented on, and a comparison was drawn between the occurrence of such an innings at cricket and the occurrence of what is called a Yarborough hand (or simply a "Yarborough") at whist. It happened that in the pages of KNOWLEDGE, about half a year before, both these unusual events had been considered, though no comparison had been instituted between them; and the writer of the letter in the *Times* touched on the circumstance that the kind of innings which had been described in KNOWLEDGE as altogether unusual should have presented itself within so short a time. He expressed also the opinion that it must be more unusual than a Yarborough, a point about which there can be no manner of doubt.

At first there seems to be no resemblance between the chance of a "perfect innings" at cricket and that of a Yarborough hand at whist; but, in reality, they both belong to the same class of questions in probabilities.

A Yarborough hand at whist is one in which there is no card above a nine—in whist estimation, according to which the ace is very much above the nine. The hand is called a Yarborough, because early in the century Lord Yarborough, a sporting peer, was in the habit of offering odds of a thousand to one (generally in guineas) that the deal would not give the person with whom he wagered a hand of this objectionable kind. Observe, we say, "the person with whom he wagered." Often the wager is wrongly described, as if Lord Yarborough betted against the deal giving a Yarborough to any of the four players. Had this been the wager, Lord Yarborough would have lost money over his venture; as it was, the story runs that he gained considerably, and it is certain that if he only laid the odds often enough he must have gained.

Now at first nothing can seem more absurd than a comparison between an innings at cricket and a deal at whist. But if we consider the two chances compared above, we shall find that they are much more nearly akin than would at first seem possible. In fact they only differ in kind in this, that the chance of a cricketer making double figures in a given match depends on our estimate of his skill and of the skill of the side against which he contends at the wickets, while the chance of any card dealt to a given player being below a nine is definite. Apart from this, the resemblance between the two chances in their nature is rather remarkable.

Let us consider them separately, avoiding all that is complex or otherwise unsuited to these pages. After all, this need not make our study of the subject incomplete; for all who know enough of the science of probabilities to follow complex or technical statements can supply from their own knowledge what we here omit, while to those who cannot all such statements would be unintelligible.

Suppose we are watching a deal at whist, all the hands being dealt in the usual way, except the hand of the person with whom the wager has been made that he will not get a Yarborough. His hand, let us suppose, is dealt face upwards, as in single-dummy whist. Of the thirteen cards in each suit eight fulfil the conditions of the wager, so that there are 32 cards in the pack any one of which will do for the first card dealt to this up-turned hand. The chance, then, that at the first round the bettor will not get an ace, king, queen, knave, or ten is clearly 32 in 52, which we represent as a fraction. Supposing the first round favourable, there remain 31 cards any one of which will suit, out of 51 unknown cards. The fact that three other cards have been already dealt, face down, in no sense affects the chance of success at this second round: all we have to consider is that a card has to be dealt which may be any one of the 51 unknown or undisclosed cards. For this round, then, the chance of success is 31 in 51, which again we represent as a fraction. The chance for the third round is 30 in 50; for the fourth, 29 in 49; and so on till we come to the thirteenth round, for which—always supposing that all the preceding rounds have been favourable for the player's wager—the chance will be 20 in 40, or exactly one-half.

Now, it is a well-known rule in probabilities that to find the chance of a series of events coming off in the way above imagined, we must multiply together the chances of the several events of the series. Thus, the chance of head being tossed at a single trial being one-half, the chance of tossing head twice in two trials is half of half, or a fourth; the chance of tossing heads thrice in three trials is half a fourth, or an eighth; and so on as far as we please, till (for example) we find the chance of tossing head twenty times in twenty trials to be less than one-millionth. Applying this rule to the Yarborough wager, we find the chance of a Yarborough hand represented by a fraction whose numerator is obtained by multiplying together the thirteen numbers from 20 to 32, both inclusive, while its denominator is obtained by multiplying together the thirteen numbers from 40 to 52, both inclusive. If the reader cares to carry out this multiplication (first, however, striking out all that is common to both series), and then to divide the large denominator he will get by the smaller (though still considerable) numerator, he will get the fraction 1 divided by 1,828 and something over.

It follows that at any given deal a player at whist has rather less than one chance in 1,828 of that kind of hand in which every lover of whist delights so greatly—a hand in which there is no card above a nine. The odds against this pleasing result are therefore rather more than 1,827 to 1;

* The innings in question is worth quoting. It was played by an Eleven of England at Scarborough, September 4, 1886, and is not only remarkable as a "perfect innings," but also as the highest innings ever played against an Australian eleven. It was as follows:—

ENGLAND.

W. G. Grace c Jarvis b Giffen	92	Flowers c M'Ilwraith b Garrett....	82
Scotton c Palmer b Trumble	71	Briggs c Jarvis b Garrett	21
Bates c Bruce b Spofforth	53	E. F. S. Tylecote c Palmer b Giffen	31
Barnes c and b Garrett	45	W. E. W. Collins not out..........	56
Barlow b Palmer	16	Extras	21
Ulyett b Palmer	48		
C. I. Thornton st Jarvis b Palmer	22	Total	558

The play of the Australians in the unfinished match was as follows:—

AUSTRALIANS.

G. E. Palmer c Briggs b Barnes....	22	T. W. Garrett c Ulyett b Briggs ..	1
S. P. Jones c Tylecote b Barlow ..	24	J. M'Ilwraith b Barnes	4
G. Giffen c Thornton b Barnes	18	H. J. H. Scott not out	8
G. J. Bonnor retired hurt..........	16	F. R. Spofforth b Briggs	31
J. W. Trumble b Flowers..........	24	Extras	12
A. H. Jarvis b Briggs	18		
W. Bruce c Briggs b Barnes	23	Total	231

SECOND INNINGS.—G. E Palmer st Tylecote b Briggs, 75; S. P. Jones not out, 108; G. Giffen not out, 7; extras, 2; total, 192.

and in offering only 1,000 to 1 Lord Yarborough was acting (unintentionally no doubt) like those judicious but dishonest bookmakers who offer the young verdants of the turf 10 to 1 against a horse, when the true odds are nearer 20 to 1—or otherwise shorten the true odds against the horses in a race, making themselves safe on every race, though one or two of their victims win largely for the nonce, and so more surely become their prey, and induce others to fall into the same net. If we imagine 18,280 wagers on the Yarborough plan, about ten would result in loss to the peer; and the winners, as they pocketed severally their thousand pounds, would be apt to think "What a fool his lordship must be!" while bystanders witnessing the transaction would pity his folly, and repeat to themselves the good old proverb which indicates the swift separation of the unwise and his property. But the loss of ten thousand pounds or so (for, of course, there might be two or three more Yarboroughs, or two or three less, than the exact average) would be more than compensated, so far as the hereditary legislator was concerned, by the sum of 18,270*l.* which he would have pocketed during the proceedings. He would probably have secured a profit of 8,270*l.*; he would be practically certain to have secured a profit of at least 4,270*l.*, and his risk of not securing the full average profit of 8,270*l.* would be balanced by his chance of securing three or four thousands more than that amount.

Such are the conditions and chances in the matter of the notorious Yarborough wagers, which in these days of purity are no longer possible—our tempters of fortune having found more speedy ways of ruining themselves in "cover" speculation and the like.

Now consider the conditions and chances in regard to a "perfect innings" at cricket.

Here we no longer have definite chances to deal with. Yet, if we consider a given cricketer playing against a given eleven, it must be admitted by all who know anything of cricket, even with all the glorious chances of the game, that a fair estimate can be formed of the chance that he will get into double figures. In the first place, his batting average for previous seasons is known. How far during the actual season he is playing up to his usual standard is also known. The strength of the bowlers and fielders playing against him can in like manner be estimated, and the state of the ground and of the weather are also given conditions of the problem. A good cricketer in such circumstances would not hesitate long in forming an opinion as to the chance that such and such a player going in under such and such conditions to meet such and such an eleven would reach double figures. For instance, if Mr. Grace, or Mr. A. G. Steel, or either of the Reads—amateur or professional—were going to the wicket early in a game against a first-class county eleven, we know that any cricketer would regard the chance of the player making double figures, the ground being in good condition and the weather favourable, as considerably more than one-half, more even than two-thirds or three-quarters. On the other hand, when a player remarkable rather as a bowler or a wicket-keeper than as a bat goes in, late in the game, against the same eleven, we know that the chance of his making double figures is much less than one-half, and may even be less than one-tenth or one-twentieth. Of course, the event in either case may upset all such anticipations. A Grace may be out at the first ball, and a Shaw or a Sherwin, the pride of his eleven because of marvellous skill with the ball or over the bails, may go in last and pile up thirty or forty runs, to the disgust of the opposing eleven, which had regarded the innings of their opponents as already over. But the estimated chance was none the less correct.

Now it so chances that just as there are thirteen chances to be considered in the case of a Yarborough hand at whist, one chance for each card, so are there thirteen chances to be considered in the case of a perfect innings of cricket, viz., one for each player of the eleven, one for the extras, and one for the "not out" man. This last chance must clearly be considered as distinct from the several chances of the eleven. One man must carry out his bat: we cannot tell who may be the man, but whoever it may be, he clearly will have had two chances to contend against: first, the chance against his making his double figure before yielding to the enemy's attack, and secondly, the chance that the last of the wickets will fall, though he maintain his own defence, before he has attained double figures. We may fairly regard this extra chance as equal to the average chance of a member of the eleven getting into double figures, since the "not out" man may be any one of the eleven.

In the case of any given innings then, to be played by eleven men of known skill against an eleven whose bowling and fielding abilities are also known, we have in effect, as in the Yarborough problem, a series of thirteen known chances to consider, each one of which must turn out favourably that the innings may be a "perfect" one. We set down our estimate of the chance in the case of each man that he will pass the nine and so enter among the double-figure men. We take the average of these eleven fractions as the chance that the "not out" will have made his double figures before the tenth wicket has fallen. And lastly we get a thirteenth fraction to represent the chance that the extras will run into double figures by considering what are the chances in regard to the innings to be made by the eleven as a whole, and what proportion the extras are likely to bear to the total innings. Thus, as in the Yarborough problem, we have thirteen fractions representing the series of chances, all of which must turn out favourably, if the innings is to be "perfect," and, multiplying them all together, we obtain the chance of that event.

Of course for each match played the calculation of the chance of a perfect innings would be different. If players of the strongest defensive force form the eleven, even the bowlers being great batsmen, like Steel (A. G.), Studd (C. T.), Ulyett, Emmett, and the champion himself, the chances of a perfect innings are much less than where an eleven, as usual, divides its strength more definitely between batting and bowling, and includes a man or two selected for skill rather in saving than in making runs, or for such quickness as makes a good wicket-keeper so destructive, or a keen point or short-slip so effective both in saving runs and catching out players. Then the qualities of the opposing eleven have to be considered. They may be such that even an eleven of the most effective batsmen may be compelled to play a defensive game, insomuch that though that game may prove a winning one, it is not likely to run into high figures.

All one can do in each case is to consider, according to the best evidence available, what chance this player has or that of making not fewer than ten runs against the opposing eleven, and then combining the chances by multiplying, as already explained. Thus one might put down the chance of the first players, A and B, as one in two, and of the remaining nine players in order as one in three, three, four, four, five, five, six, ten, ten; the chance for the not out, whoever he may turn out to be, might be put at one in twenty, and the chance of a double figure for extras at one in two. Then the chance of a perfect innings would be represented by one in the product of the thirteen numbers—two, two, two, three, three, four, four, five, five, six, ten, ten, and twenty. This product will be the product of the numbers 20, 20, 20, 20, 20, and 108, or 345,600,000, so that the odds would be 345,599,999 to 1 against a perfect innings. But, on the other hand, the eleven might be so strong, and opposed to such moderate bowling strength, that the chances for the 11 players, the not-out chance, and the chance for extras, might be represented by 5 in 6, 4 in 5, 2 in 3, 2 in 3, 5 in 8, 3 in 5, 3 in 5, 1 in 2, 1 in 2, 1 in 3, and 1 in 4, for the eleven players; 3 in 8 for the "not out"; and 4 in 5 for the extras. Then the chance of a perfect innings would be represented by a fraction whose numerator would be the product of the numbers 5, 4, 2, 2, 5, 3, 3, 1, 1, 1, 1, 3, and 4, while its denominator would be the product of the numbers 6, 5, 3, 3, 8, 5, 5, 2, 2, 3, 4, 8, and 5—which is evidently 1 in 2,400 (all the first set of numbers cancelling against numbers or parts of numbers in the second set).

It must be quite common for the chance of a perfect innings to be less than one in a million, so that in a match of four innings it would quite commonly happen that the chance of a perfect innings would be less than one in a quarter of a million.* Often the chance of a perfect innings in a match is less than one in several millions. Very seldom, indeed, can the chance of a perfect innings be so large as one in 4,000 for an innings, or one in 1,000 for the match. It always seemed to me about as likely as this that during some of the matches played against the Australians a perfect innings would come off, because the Australian eleven has had bowlers and a wicket-keeper who might be safely trusted to make a good average also with the bat, and when England had to select elevens to meet them, it was desirable (especially during their first three visits) to select bowlers of the same quality. At the wicket, Mr. Tylecote among amateurs and Pilling among professionals could always be expected to make a good score with the bat, and, although Sherwin is in that respect not their equal, yet it has more than once happened that he has got into double figures even against the powerful attack of the Australian eleven in 1884 and preceding years. As for bowlers, though it is customary to say that the Australians are ahead of us in the combination of bowling and batting strength, I cannot think that any five among all the Australian teams would in this respect surpass Messrs. W. G. Grace, A. G. Steel, C. T. Studd from among our amateurs, and Ulyett and Emmett from among professionals, while to these five ten more might be added, of scarcely inferior quality, from the elevens of Nottingham, Yorkshire, Lancashire, Surrey, Gloucester, Kent, and Sussex. With elevens made up so as to have no "tail," the chance of a perfect innings is greatly increased. Yet I should imagine that no two elevens have ever met whose chance of giving, in the match, one perfect innings has been equal to much more than one in a thousand. Such encounters, also, are so few and far between that the small chance in any given match is not made up by the number of trials. Taking all the cricket matches played year after year, and a fair computation of the average chance of a perfect innings in a match at not more than 1 in 100,000, we cannot wonder if season after season passes without a perfect innings being recorded. For, counting thirty weeks in the cricket season, and supposing twenty matches going on daily of the kind which we are considering, each lasting three days, we only get 1,200 encounters in the year, so that there might be expected one perfect innings in rather more than eighty-three years!

So far as I can learn there have not been more than two or three perfect innings before that of last year, and there has never before been a case in which every item of the score exceeded fifteen.

* Although four innings are not played in every match, we may fairly set against the chance of four full innings not being required the chance that when this happens one innings on the winning side will be exceptionally large. Manifestly (for example) if one side is beaten in a single innings, there is more likelihood of that innings being a perfect one than if four innings, all perhaps of nearly equal value, were played out.

CURVES IN BASE-BALL PLAY.*

THE great curves, as recently photographed, are shown in fig. 1. In explaining these curves, E. J. Pringle says that the picture represents two kinds, an in-curve and an out-curve, and there are two methods for using each of them. One is to start the ball in a direct line for the home base and the curve will carry it to the left of the base. Another is to start the ball in a direct line for the batsman and let the ball curve over the plate. The latter curve, however, is

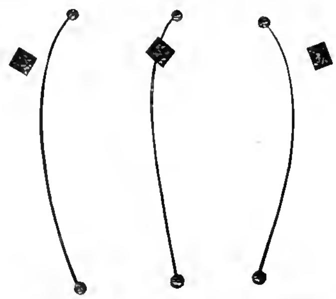


FIG. 1.—IN-CURVES AND OUT-CURVES PASSING THE HOME BASE (AS PHOTOGRAPHED).

not safe unless the pitcher has a good command of the ball. The in-curve is much the best, provided the pitcher is expert enough to use it.

The in-curve and out-curve are probably the easiest of the pitcher's curves, while the drop and the rise ball are the hardest. The different curves now in use were discovered by different persons, but all pitchers are now perfect in them.

Arthur Cummings was undoubtedly the first to discover the out-curve when he pitched for the Stars of Brooklyn back in 1869. It was then that he suddenly found that he could strike out batsmen when he pleased, and he also noticed the ball curve, but why, he did not know himself. He practised hard, and finally found that it was done by a certain curve of the wrist and the way the ball was held.

To throw the out-curve: The ball should be grasped firmly with the first two fingers of the right hand with the thumb on the opposite side and the other two fingers close in the palm of the hand. Use the underhand throw, and carry the hand forward midway between the shoulder and waist. When the ball is released the palm of the hand must be turned exactly upward, the first two fingers pointing as near straight as possible.

When the ball is thrown (fig. 2) it can be released either by drawing the thumb back or by turning it over to the right and allowing the ball to roll around the side of the forefinger, and not off the tip. A neat way of getting a grip on

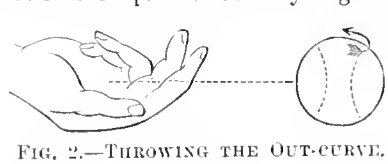


FIG. 2.—THROWING THE OUT-CURVE.

the ball is to catch the middle finger on the seam of the ball. By so doing one can cause the ball to rotate more

* From the *New York Sun.*

rapidly. These same movements are performed by a left-handed pitcher for an in-curve.

To throw a low in-curve the ball is held firmly with all the fingers and the thumb on the opposite side. A straight side motion is used, which brings the hand well out from the body and on a level with the shoulder. In this curve, when the ball is released, the palm of the hand is turned exactly towards the left, with the fingers sufficiently closed

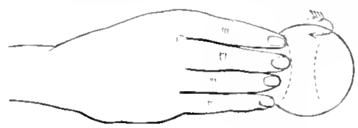


Fig. 3.—Throwing a Low In-curve.

around the ball to give it the required rapidity of rotary motion. The ball is released while the hand is in this position (fig. 3). This curve can be greatly improved by catching hold of the seam of the ball with the ends of the first three fingers before throwing it. This curve is, perhaps, the easiest one to acquire. Very often a beginner can throw a good in-curve the first time he tries.

In a high in-curve the hand passes above the head with an overhand motion.

The "Only" Nolan was probably the first pitcher to use the down-curve, and he met with remarkable success. In throwing a down-curve the ball is held in the same manner as for the in-curve. An underhand throw is generally used for this curve. When the ball is released, the hand is held

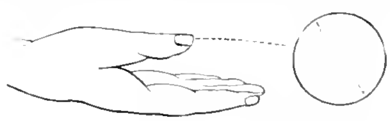


Fig. 4.—Throwing a Drop-curve

pointing directly towards the home base, with the palm turned upward, allowing the ball to roll off the tips of the fingers (fig. 4). This curve is to-day one of the most deceptive in use on account of the inclination of the ball to drop anywhere but at the right place.

Radbourne is one of the successful men with the up-curve. The up-curve was introduced by McCormick of the Pittsburgs some years ago. This is the most difficult curve to pitch, and but few ever become perfect in it. Every one knows that the ball is likely to curve downward, and in order to overcome this downward tendency great swiftness must be used to get sufficient resistance from the atmosphere. In pitching an up-curve the ball is held in the same manner as for an out-curve. The hand is thrown forward and downward with a quick jerk. As the hand goes downward

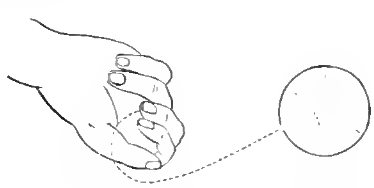


Fig. 5.—Throwing the Up-curve.

it should pass the knee and go at least a foot to the front of it before the ball is released. Just as the ball is thrown the little finger edge of the hand will be turned upward, and the palm will be in such a position that the pitcher can look into it (fig. 5). The first two fingers will be nearly horizontal and pointing directly away from the pitcher. The ball is released from this position by allowing it to roll under the first finger, and assisting the progress by a twist of the thumb. The ball should roll off the side of the finger, and not off the tip.

These are by no means the only curves used by the pitchers nowadays. There are the out-rise, in-rise, out-drop, and in-drop, all in the nature of two curves. Then there are several different "shoots" used; they are in the nature of a quick curve.

Avery, the famous Yale pitcher, probably never curved the ball, yet he discovered the in-shoot. It is now no unusual thing to find a pitcher with all these points, and many more wrinkles that they keep working up. Change of pace was most beautifully illustrated by Al. Spalding in the old Boston champions. Tim Keefe of the New Yorks is now the most successful in that line, while Clarkson of the Chicagos is also working the change of pace to good advantage. Will White and John Ward were about the first to work the sharp curve and in-shoot as far back as 1878. One of the greatest pitchers that ever twirled a ball was Charlie Sweeney, who was with the Providence Club in 1883-84. He was the first and perhaps the only man who could curve an out-ball to a left-hand batsman. Several of the pitchers can get a shoot, but his was a clean curve.

Even with all these, curve-pitchers are not satisfied, nor will they be until they can pitch a ball that will stop in the air just before reaching the home-plate, and wait until the batsman has made a strike, and then pass on to the catcher.

In curving the ball in the wind, E. J. Prindle says:—"Throwing an out-curve from north to south curves the ball to the east. Now, if the wind is blowing from the east it will retard the curve, and it may, if very strong, entirely prevent it. In pitching from north to south, an east wind will assist an in-curve, a west wind will assist an out-curve, a south wind will assist any curve, and a north wind will retard any curve."

THE SUN'S INTERIOR.

It is strange, but nevertheless true, that the study of our earth's crust has taught science something about the interior of the sun, or rather about what lies below the visible surface of the sun, which we call the photosphere. The evidence is not at present precise, but it is not difficult to see that along the line of evidence thus afforded a much greater approach to exactness can be made than has hitherto been obtained.

When the geologist examines the earth's crust, he finds evidence of the fast progress of changes such as are now in action, during millions, nay tens of millions of years. Thus, among the rock strata of the earth are to be found traces of the action of rain and water, wind and storm, alternate heat and cold. Among the fossilised remains found in these rocks are some which indicate the presence of forms of life which could only have existed where there were light and heat. Among all the strata, evidence is to be found of the action of changes such as are produced by solar action alone. Thus in the rocks of the earth we have evidence of past solar activity, and the means of determining how much work was done by the sun.

It matters nothing, so far as this inquiry is concerned, whether we consider the sun to have been more active or less active in the past than he is now, for it is the total amount of work he has done upon the earth which we have to consider, not the rate at which it was done.

Dr. Croll, of Glasgow, one of the most careful of our geological inquirers, finds evidence in the rock strata of Scotland showing that the amount of work done by the sun on the earth corresponds to at least 100,000,000 of years of sun-work, at the sun's present rate of emission of heat. The late Sir Charles Lyell, who carefully examined Croll's investigations, was satisfied that this estimate probably fell short of the truth rather than exceeded it.

But if there is one result which comes out clearly from modern physical inquiries, it is that the sun's emission of light and heat are due almost wholly to his gravitating power, to the might by which he has been drawn and is drawing in towards his centre the material now forming his globe. Some little extra energy may arise from the drawing in of matter external to his globe: but it can be but very little compared with that due to the mass already within the solar globe as we see it, and the contraction which this mass has still to undergo. Now, the force of contraction, if it is supposed to have acted to draw in matter originally at exceedingly great distances, until the whole mass has been brought within the compass of the sun's present globe, throughout which it is uniformly or nearly uniformly strewn, could not have corresponded to more than about 20,000,000 years' emission of heat and light at the sun's present rate of working. This would only correspond to about one-fifth part of the amount of work which—judging from the earth's crust—the sun has actually done.

How are we to explain the apparent discrepancy between the evidence given by the earth and that given by the sun? Very easily, according to Dr. Croll, though for my own part I find his explanation very difficult to accept. He thinks that a part, and a very large part, of the sun's heat may have been derived from the motion of masses originally non-luminous, rushing with enormous velocities through space. He says, quite truly, that if we are asked whence they derived those velocities, we are in reality no more called upon to reply than we should be if we were asked whence they derived their substance. But he seems to me to overlook the enormous improbability of collisions occurring between masses thus travelling about through inter-stellar space. To conceive that the stars we see, either with the unaided eye or the telescope, were originally formed by the conflict of bodies originally rushing darkling through space, is to conceive something as unlikely as that the bullets fired by two widely-scattered bodies of opposing skirmishers should be constantly encountering in mid-air—or rather, it is to suppose what would be far more unlikely.

Moreover, whatever heat might be generated by such collisions, were they possible in the required number, would be dissipated quickly, and long before any attendant orb like the earth could possibly have begun to be the abode of life.

It seems to me, then, that we are driven to a very different explanation—this, namely, that the process of contraction has gone on much farther than it seems to have done, and that consequently much more of the sun's work has already been accomplished than had been supposed. According to this view, the sun's real globe is very much smaller than the globe we see.

The knowledge thus obtained about the sun's interior has been derived from the crust of the earth.

But so soon as we have thus been led to recognise the remoteness of what we call the sun's surface (that is, the solar surface we see) from the real surface, other evidence towards the same view begins to present itself. Thus the marvellous motion of the solar spots, by which it has been shown that the equatorial zone of the sun gains one entire revolution in eight on the zone of spots farthest removed from the equator, would be impossible were the surface we see anywhere near the real surface. We are absolutely compelled by this amazing freedom of motion in the solar photosphere to admit that in all probability the real globe of the sun is very much smaller than the globe we seem to see, limited by the surface which happens to have that degree of brightness which prevents us alike from seeing below except where spots exist, or from seeing outer layers, except during the time of solar eclipse.

There is another proof of the condition of the sun's interior, which is more recondite and difficult. Professor G. H. Darwin (a son of the late Charles Darwin) has shown, by mathematical computations of the most convincing kind, that if the sun's visible globe were of anything like uniform density throughout there would be recognisable compression at the solar poles. Now, all the most careful observations of the sun agree in showing that if such compression exists at all, it is so slight as not to be discernible with the best telescopes yet made. It follows that the sun's globe must be greatly condensed towards the centre.

It is interesting to note that if the view to which we have been led is correct—and it is difficult to see how it can be otherwise—the sun has passed through a greater portion of his career as a light-emitting, heat-radiating, and consequently life-supporting orb, than has been supposed. In point of fact, the difference is so great as probably to reduce by more than three-fourths the estimate science makes of the length of time during which the sun will continue to supply adequately the heat and life necessary for our earth and the other worlds circling around him. Albeit, there is no reason to suppose that for many millions of years yet to come the supply will run short. Moreover, man is exhausting the life supplies of the earth herself at such a rate that what we now regard as civilised life upon the earth must die out millions of years before the solar emission of light and heat will probably be appreciably reduced.

This point, the wild waste of the earth's life stores, which, millions of years in accumulating, will be exhausted in a few thousand years at the outside, if the present ever-growing rate of consumption continue, will be considered next month.

Gossip.

Most men, in looking back over their lives, recognise events which have seemed exceptionally lucky and others which have appeared the reverse. The whole bearing of my little treatise, "Chance and Luck," shows that I am no believer in luck which may be counted on; or, therefore, in luck worth considering at all. But there have been times when I have been specially fortunate. For example, that just when I had been scolded for holding persistently the solar theory of the corona, photography should come in and confirm all I had maintained, was singularly fortunate: for everyone understood *that* argument. So, when I had maintained the theory that nebulæ are parts of our galaxy, I could not hope that a new star would be seen to die out into a gaseous nebula (in Cygnus), that another new star would appear in the famous star-cloud in Andromeda, and that a new nebula would be detected by photography in the midst of the Pleiades, and clinging so manifestly to one of the stars there as to leave no doubt that the nebula really lies in the midst of the cluster. Yet, again, I was very lucky in that just when the Astronomer-Royal, admitting the exactness of all my calculations in regard to the recent transits of Venus, explained lustily that the stations I suggested could not be occupied, and, therefore, would not, American and other astronomers proclaimed that those stations could be occupied, and should be, and proved their case and mine by occupying them forthwith, and making excellent observations.

* * *

Such pieces of luck are not common even in a lifetime. Yet I consider myself even more exceptionally lucky in that my business took me to America in 1873–74, when the Tichborne trial was in progress, filling three-fourths of the space in our English newspapers, occupying nine tenths of men's talk and attention.

* * *

I have been luckier yet in that throughout all this Jubilee business I have been where the distant hum of it all scarce even reached men's ears.

* * *

In these days no man can be an Admirable Crichton—assuming the actual Crichton was really so well informed in all the science of his day as men said. But if any man has a chance of taking even a bird's-eye view of the science of our time, or of its history during, say, the past half-century, it can only be a man who is thoroughly grounded in mathematics. The effect of trusting even the sketching of general science to men who are not mathematicians, however eminent they may be in special departments of research, must ever be disastrous. Of this truth the last few months have afforded more than one "awful example."

* * *

It should be obvious, of course, that no man can appreciate the work done in our time in physics, astronomy, mechanics, and kindred departments of science, without being well versed in the general principles of mathematics. But, as Galton well pointed out when, in dealing with a subject seemingly biological, he found mathematical formulæ essential to successful inquiry, mathematics is "queen of the whole domain of science."

* * *

Apart from the direct application of mathematics in nearly every department of science, the mathematical turn of mind is of important service even where no mathematics may be employed or required. To recognise the truth of this, one need only notice the failures which men not mathematically trained to close reasoning, nor by nature gifted with mathematical potentiality, almost invariably make in scientific researches of any difficulty. I know of no example of a continuous series of investigations, logically pursued to final success, by any man not mathematically minded. Darwin, Tyndall, and Spencer, who have done no independent mathematical work, have been pre-eminently mathematical in their manner of working and thinking. And some even who have objected to the too purely mathematical treatment of their special subjects have shown clearly that, had they not been great in such special work, they might have been eminent in mathematics.

* * *

I have been asked by a correspondent in America what are "the curious phenomena of the instantaneous reversal of comets' tails on passing their perihelion," referred to in a recent article on the progress of science. I really am unable to say. A comet's tail is directed along the major axis of the orbit when the comet is in perihelion, and does not point in the reversed direction unless when the comet is in aphelion, when, however, a comet usually has *no* tail. I have never heard of the instantaneous reversal of a comet's tail either at or near perihelion. The only cases of quick reversal occur where a comet's perihelion is very near the sun, when it has happened (in perhaps half a dozen cases out of hundreds) that, in the course of a few hours, a comet's tail has been actually reversed, as the comet's head has passed, in that short time, from a position on one side of the sun to a position on the side exactly opposite. But the reversal does not take place at perihelion, but as the comet passes from one end to the other of the *latus rectum* of its orbit—a line *at right angles* to its direction from the sun when in perihelion. Nor is the reversal ever instantaneous. In the case of the great comet of 1811 the reversal was not completed in much less than a year. There is no other mystery in such reversal, whether slow or rapid, than there is in the general law that a comet's tail is turned always from the sun, of which these reversals are but special cases.

* * *

A correspondent at Pernambuco asks me (or rather, I should say, asked me a long, long time ago) whether the right saying is "*De mortuis nil nisi bonum*," or "*De mortuis nil nisi bene*." I never had any classical knowledge worth speaking of, though I read my Homer, my Virgil, and my Horace, my Euripides and my Terence, with ever-growing pleasure and satisfaction—which, I find, is not always the case with those painstaking college friends of mine who could descant most learnedly on the force of *κατά* in composition, and like delectable details. Frankly, I have not the slightest idea where the expression which in England we render always *de mortuis nil nisi bonum* had its origin. If such origin is known, the question of the right form can probably be at once disposed of. Yet, after all, even this is doubtful. Every one knows that Virgil (or Vergil—which is it?) wrote *Facilis descensus Averni* or *Averno*; yet no one would pretend to aver that *Averni* or *Averno* is right, in face of the fact that while many excellent editions give one form, many not less excellent give the other—the old Delphin and the modern Oxford agreeing in *Averno*, which is the form I always employ myself.

* * *

My Pernambuco correspondent, who is a naval officer (and whom I beg to thank for a highly interesting letter) writes that every German at his station gave *bene* as the right reading, every Englishman giving *bonum*. A German paper which was referred to on the subject thanked its correspondents for their trust in its Latinity, and explained that since the expression *De mortuis nil nisi bonum*, or *bene*, is short for *De mortuis nil nisi bonum vel bene dicitur*, or "Let nothing be said of the dead but," &c., *bene* the adverb *must* be preferable to *bonum* the adjective. To one who has no pretensions to Latinity, *dicitur*, as used by this classical authority, sounds appalling. In my ignorance I should have suggested *dicatur*. But be that as it may, I cannot but think his dogmatic decision open to question. In reading dear old Cicero I have come across the suggestion *Ut nihil præter verum diceretur bonum*; and Latin good enough for Cicero is good enough for me, however unsatisfactory it may seem to our classical German editor.

* * *

Of course all English readers remember Thackeray's Roundabout Paper "Nil Nisi Bonum," which settles the question of customary English usage.

* * *

Speaking of familiar Latin sayings and quotations, I frequently notice in English, American, and Continental papers the rendering (in their various vernaculars) "I fear Greeks and those who bring gifts," as conveying the idea expressed in the familiar "Timeo Danaos et dona ferentes." Laocoon, we may be sure, addressed no such feeble warning to his countrymen, when he closed his ardent address with the familiar words :—

Equo ne credite, Teucri.
Quidquid id est, timeo Danaos et dona ferentes.

Scan the line, and the stress falling on the *et*, as it closes the heavy spondee before *dona ferentes*, would of itself suffice to show that it means not merely "and," which in that position would be inane, but "even" or "even though." The Greek *καί* had a similar force, as in the well-known line, Ἕκτορα, καὶ μεμαῶτα, μάχης σχήσεσθαι ὀΐω. What would be thought if this line were rendered "I will keep back Hector and one raging," instead of "Hector, even though (he be) raging"?

* * *

The lateness of my reply to my Pernambuco correspondent reminds me to remark here that I receive many letters at my distant home, on the banks of the Missouri, after they have made a roundabout journey through London, to which it seems idle to respond, so late as my answers would appear, especially if sent from St. Joseph at such a time as to reach Messrs. Spottiswoode just after a number was ready for the press. I appreciate, however, very much the kindly letters I constantly receive.

* * *

At St. Joseph, by the way, we have been having during the last week some rather trying weather. What would they think in England of a week during which the afternoon thermometer has shown each day over 100 degrees in the shade, while even in the night the temperature has scarcely once gone below 85 degrees? On one day the number of deaths from sunstroke (probably encouraged by whisky nips and unsuitable food) must have risen throughout the States to over a thousand, judging from the number officially recorded in the larger towns.

* * *

As one correspondent sends me a cutting from the *Pall Mall Gazette* describing a meteor seen at "St. Joseph, a village in Iowa," marking this passage as probably referring really to St. Joseph, Mo., I may as well point out that St. Joseph, Mo., is not a village but a large town, numbering 50,000 inhabitants, with a dozen banks, three dozen churches, several hotels, one of which is about half as large again as the Grand Hotel, Brighton, and railway communication by ten lines with surrounding regions, to which even as I write three new lines are being added. St. Joseph is placed as the second richest city in the United States, in proportion to its population, Portland, Oregon, being the first; and as the Clearing House records for the last half-year have indicated a constant advance on the corresponding weeks of last year by from 40 to 90 per cent., it may be inferred that St. Joseph is a thriving city. It has been considered rather old-fogeyish for some years past, most of its wealthier citizens having rather set their face against improvements. But a change has recently come over St. Joseph in this respect, and improvements are now in progress everywhere throughout its extent.

* * *

I suppose there must be a score of St. Josephs or more in the United States.

* * *

I often wonder at the novel experiences I encounter in lecturing, because after giving 2,000 lectures one would suppose there could hardly remain anything new to be met with. But my last lecture in America, given on July 4, a broiling hot day, at Lexington, Kentucky, brought me a stranger and more unpleasant experience than in nearly a score of years' lecturing I have ever encountered. I was to give two lectures for a semi-religious, quasi-scientific body, called the Chantangua Society, whose object seems to be to provide cheap lectures, Chinese lights, literary scrap-work, and holidays, profitable to promoters, all over the States. I might have suspected something of what was in store for me by the beggarly nature of the terms offered me. But I have had pleasant times in Old Kentuck, and notably in Lexington, so I elected to travel 1,400 miles and give a week's work for about a fourth of the fair price—(the labourer at 95 in the shade is worthy of his hire). The society, which cleared a large enough profit to buy the ground on which the entertainment was held, could not afford, it appeared, to hire my lanternist, nor to engage a lantern and lanternist in Lexington: but borrowed a lantern (I was, unfortunately, foolish enough to lend them mine), and undertook to work it by some capable volunteer. The lantern was sent on four days before I arrived, and at my cost. I supposed, of course, that the volunteers would try their hands at working it, according to printed instructions forwarded them. To make a long story short, I was met on arrival at the grounds just before the first lecture, with the appalling question, "What gases do you use for this lantern?" We used none, I need hardly say, *that* night, and I left Lexington till the next lecture, having given the secretary—a Professor (*sic*) W. D. Clintock—very clearly to understand that if his volunteers could not work my lantern, he must hire a properly trained lanternist. Will it be believed that on the night of the last lecture, three days later, they had not learned even how to fix the lenses? They broke the condenser by setting it too near the glowing lime, failed to get any disc on the screen, and, adding insult to injury, the Rev. Professor, otherwise the hopeless incapable to whom the fiasco was due, deliberately told the audience that as I had lent the lantern the fault was mine. Their applause after I had replied showed whom they believed, and I received immediately any number of assurances of sympathy from the best members of the community. But such experiences sicken even the veteran lecturer.

Reviews.

Industrial Ireland. By Robert Dennis. (London: John Murray. 1887.)—Amid the oceans of contradictory talk and reams of printed discussion with which the British nation has been so long afflicted, we can assert, quite unhesitatingly, that no contribution towards the solution of the *vexata quæstio* of Ireland equal in value to that of Mr. Dennis has so far appeared. To anyone who may feel disposed to regard such unqualified praise as partaking of the nature of hyperbole, we would simply give the advice to read the book for himself, and learn how, within the compass of 202 pages, its author shows in what way Ireland might really be made prosperous, and, as an immediate consequence, happy and contented. His remedy is no quack political panacea. He has no sympathy with the venal and unprincipled crew who, themselves living on the earnings of the cookmaids and hodmen in New York, foment agitation, lest its cessation should drive them themselves to the necessity of earning an honest living. He does not profess to believe (what honest man does?) that a Parliament of Healys, Harringtons, and Sextons on College Green would be the salvation of the country. No; his cure for the evils which beset our unhappy neighbours across St. George's Channel is of a very much more simple character. It is work—nothing more. A quotation from John Bright which appears on the title-page forms the keynote of the entire volume. "The greatest cause," said that great orator and statesman, "of Ireland's calamities is that Ireland is idle. Ireland is idle, therefore she starves. Ireland starves, therefore she rebels. We must choose between industry and anarchy." No one who has ever been in Ireland, and assuredly no one who has ever lived there, will dispute the truth of these words. The staple crop of the country, the potato, affords a perennial illustration of this. It is grown simply because it costs less trouble and work than any other. The occupier of a wretched acre or two sticks his potatoes into the ground (or rather his women-folk do for him), and leans against the wall smoking until they come up. And he calls this farming! What inexhaustible resources Ireland possesses in the shape of animal, vegetable, and mineral wealth, and how easily they might be utilised, the reader must go to Mr. Dennis's pages to discover. We cannot help feeling that the circulation of this admirable book throughout the length and breadth of Ireland might almost be a matter of State policy. Certainly any patriot who wished to confer a lasting benefit on the country might employ his money much more unprofitably than in promoting such circulation. It might render impotent the gang who earn their American wages by fomenting outrage and strife.

Romance of the Wool Trade. By JAMES BONWICK, F.R.G.S. (London: Griffith, Farran, Okeden & Welsh. 1887.)—The words "the wool trade" scarcely appear to lend themselves to romance, and yet, within the compass of this book, Mr. Bonwick contrives to pack an amount of information, much of it fresh and all of it interesting, of a character which largely justifies his choice of a title. He treats of the various sorts of sheep scattered over the face of the globe, of their breeding and management, and of wool-production as carried on here and in the Antipodes. He, further, devotes considerable space to a description of wool-manufacture, both as practised in the British Islands and in Australasia. His account of the pioneers of the wool trade in Australia, and of the difficulties against which they perforce had to struggle, might, in parts, almost be taken from the pages of a novel. The perusal of the volume on our table may be commended to everyone who is curious to learn the history of the coat on his own back.

The Kabbalah Unveiled. By S. L. MACGREGOR MATHERS. (London: George Redway. 1887.)—Beyond a general idea that the Kabbalah contains the esoteric philosophy of the Jewish doctors, we venture to think that the acquaintance of the average educated Englishman with the nature of this curiously crazy book might almost be expressed algebraically as a — quantity. Mr. Mathers, then, has rendered a certain amount of service to the mystic and the inquirer into occult methods of exegesis by his English rendering of Von Rozenroth's Latin version of the extraordinary intellectual vagaries of the Hebrew commentators on their Scriptures. That so wonderful a series of examples of misdirected ingenuity and, in places, the most utter childishness should ever have been held to have been taught by the Almighty Himself to a select company of angels, who formed a theosophic school in Paradise (!), affords tolerably strong indication of the intellectual depth to which the recipients of such a creed must have descended, or rather from which they had not emerged. It is simply impossible within the limits of space accorded to reviews in these columns to select illustrations in support of these allegations from the pages before us—even if it would not be blasphemous to do so. It must suffice, then, to say here that the Bible is interpreted by such expedients as those of forming anagrams of the names which occur in it, by assigning numerical values to letters, and so forth. To have discovered that the letters forming the words "Sir Roger Charles Doughty Tichborne the Baronet" may be transposed into "Yon horrid butcher Orton, the biggest rascal here"; or that the numbers equivalent to the Greek letters Γλαδστονη (*i.e.*, 3, 30, 1, 4, 200, 300, 70, 50, and 8) when added together give the number of the beast, 666, would have rejoiced the heart of the Rabbi Simon Ben Jochai, and probably been accepted by his followers as a direct and immediate revelation from Heaven. Verily the Bible has been wounded in the house of its friends, who have tried to read meanings into it of which its various authors were utterly and absolutely innocent; and from Ben Jochai down to Kinns have only obscured what was clear enough to every ordinary intellect already. But although we have said with perfect plainness what we think of the matter of the Kabbalah, we may add that it is worthy of perusal by all who, as students of psychology, care to trace the struggles of the human mind, and to note its passage from animalism through mysticism to the clearness of logical light and that scientific mode of thought and reasoning which can appraise the doting ramblings of the Jewish fathers at their true value.

The Religion of Socialism. By ERNEST BELFORT BAX. (London: Swan Sonnenschein, Lowrey & Co.)—If anyone wishes to see the dreary sophistry and platitudinarian rant of Messrs. Hyndman and Co. presented with such invitingness as an author possessing a certain amount of culture can confer upon it, he may find it in this volume. Whether, though, a thin electro-plating of grammatical, and even in places polished, language really renders the monster of Socialism any more attractive, or serves to conceal the stupendous fallacies underlying its fundamental tenets, the reader must judge for himself.

Disease and Sin. By a MEDICAL MUSER. (London: Wyman & Sons. 1886.)—Here we have "a hap'orth of bread to an intolerable quantity of sack" in the shape of a very few useful comments on disease, but too sparsely scattered in a very ocean of twaddle and preachee-preachee. The "Medical Muser" talks with a kind of pitying contempt of Darwin! and condemns evolution *toto cœlo*; believes that the first chapter of Genesis really gives an account of the creation of the visible universe: asserts that man was created perfect (his knowledge of the prehistoric races being, apparently, like the joint-stock companies, "limited"), and so on. His intimate acquaintance with physical science may be gauged from the single sentence we propose to quote from his book. "Light," he says, "is the primary force, for it is positively proved that it does *not* depend upon vibrations of matter"! But it is, of course, open to this unassuming author to assert that the medium filling all space whose vibrations of certain orders do affect us as light is not matter—and perhaps it doesn't matter much, after all.

Labour Capitalisation. By WORDSWORTH DONISTHORPE. (London: Liberty and Property Defence League. 1887.)—It is a long time since we have read a more able and thoughtful work than that whose title heads this notice. We will not weaken or spoil Mr. Donisthorpe's argument by any attempt to summarise it here. It must be read in all its logical sequence to be appreciated. Every one interested in the progress of the working classes, and even in the stability of the nation itself, should obtain and study this trenchant brochure. He can scarcely rise from its attentive perusal without being a wiser man. There is, by the way, one misprint on p. 18, which makes nonsense of the sentence as it stands. It consists in the omission of the words "is not" after "diameter" and before =3·14159. Even a microscopic blunder like this is out of place in an essay of such unquestionable general merit as the one before us.

The Cruise of the Land Yacht "Wanderer." By GORDON STABLES, C.M., M.D., R.N. (London: Hodder & Stoughton. 1886.)—If enthusiasm in a cause were all that is needful to make converts, then might we expect all the passable roads in the kingdom to be thronged in future with more or less luxurious caravans during spring, summer, and autumn: for surely never did man enter more thoroughly, heart and soul, into a novel form of adventure than does Dr. Stables appear to have done in his essay in

"Caravanning." His first essay in his dainty house upon wheels, made in his own county, Berkshire, proved so eminently satisfactory, that he deliberately set himself the task of travelling gipsy fashion up into the North of Scotland, and the record of this tour forms the substance of the book now before us. . . . Starting in the spring of 1886, Dr. Stables journeyed from Berkshire, through Oxfordshire, Warwickshire, Leicestershire, Nottinghamshire, Yorkshire, Durham, Northumberland (skirting the coast), Berwickshire, Haddingtonshire, Edinburgh, Linlithgow, and so to Glasgow. Back through Stirlingshire, and then north through Perthshire, and across the Grampians to Inverness. His "Land Yacht" was a two-ton copy of a gipsy's travelling van, built of solid mahogany and fitted with every conceivable comfort and elegance, giving two powerful horses nearly as much to do as they could accomplish at all in the hilly country through which it passed. The crew, all told, consisted of Dr. Stables himself, his valet cook and factotum, his coachman, a gigantic Newfoundland dog, and an Australian parrot. What he saw, whom he met, how he lived, and what real perils (notably in the ascent of the Grampians) he encountered, the reader must go to his chatty and very readable book to discover. Certainly a freer, happier, or more enjoyable life than he depicts it seems hard to imagine. Of course he is a man of intellectual resource and refined tastes, with a keen eye for the million beauties of nature, a love of music, and a soul for poetry; and it is quite conceivable that a man with fewer endowments might find such a pilgrimage a thought weary at times, especially during a sequence of wet weather; but our author paints his own experience in such fascinating colours that the British Waggon Company (who built "The Wanderer") ought to be inundated with orders prior to the next touring season. All who read this record, and they will be many, will learn of Dr. Stables's sad experience in committing his caravan to the tender mercies of the railway on his return from the far North, and will heartily sympathise with its owner in his grief and disappointment at finding how the Company, or its servants, had "made hay" of all his furniture and delicate fittings when it arrived at its destination. His book concludes with practical hints and advice to all who may think of adopting his somewhat novel form of locomotion, and to such it will be found as useful as it is amusing.

The Young Tea-Planter's Companion. By T. F. DEAS. (London: Swan Sonnenschein, Lowrey, & Co. 1886.)—It is only within a comparatively few years that tea-planting in Assam has come to be regarded among the businesses or "professions" to which an educated English youth may profitably devote himself, and has supplied yet another answer to the increasingly difficult question, "What shall we do with our sons?" Mr. Deas, in the entirely practical book before us, goes into the minutest details of the work of a garden and factory, and gives explicit instructions for the cultivation of the plant, its picking, drying, and packing, and even the method of keeping accounts on a tea plantation. Plans and sections of the buildings and bungalows needed are given, with details of their construction: in fact, the work is a complete *vade mecum* for the young planter newly entering upon his work.

Lunar Science: Ancient and Modern. By the Rev. TIMOTHY HARLEY, F.R.A.S. (London: Swan Sonnenschein, Lowrey & Co. 1886.)—Mr. Harley's book is one which it would be difficult to classify, so inextricably are astronomical constants and sermonising intermixed in it. It contains a considerable amount of fairly trustworthy information on the size, weight, distance, and motions of our satellite; but, if it is to be accepted as a work of reference in connection with these constants, it is a pity that its author did not go to some standard authority like Neison for his quantities, and not depend upon a mere compiler like Mr. Lockyer. In connection with this, should the work before us ever run into a second edition, Mr. Harley may with advantage make the following corrections of statements to be found in pp. 9, 10, 11, and 17. *Imprimis*, the moon's mean distance is 238,840·25 miles, her maximum distance, 252,972 miles; and her minimum distance, 221,614 miles. Moreover, her true diameter is 2,163·06 miles. In the next place, the earth's equatorial diameter is 41,852,404 feet—*i.e.*, 7,926·59 miles—and not "just under 7,926 miles," as stated in his text. These are comparatively trivial amendments, but anyone writing a treatise on lunar physics in the year 1886 is at least bound to furnish his readers with the latest results of investigation in the subject of which he treats. With one portion of Mr. Harley's book we are unfeignedly pleased. With a regard for truth at once creditable to him as a man of science and a clergyman, he discusses the alleged miracle described in Joshua x. 12, 13, only to come to the conclusion that, as he says, "We do not for a moment hesitate to pronounce the story to be apocryphal in essence, and poetical in form." For his cogent reasons for arriving at this conclusion we must refer the reader to the book itself. How much of the book of Joshua was inspired it is needless to discuss here. It is abundantly certain that the interpolation from the book of Jasher was not. The reader unfamiliar with current works in astronomy pure and simple may learn a good deal from Mr. Harley's pages.

Rust, Smut, Mildew, and Mould. An Introduction to the Study of Microscopic Fungi. By M. C. COOKE, M.A., LL.D. Fifth edition. (London: W. H. Allen & Co. 1886.)—Now that a really serviceable microscope is purchaseable for about 5*l.*, and the instrument has become widely popular and diffused to an extent which fifty years ago would have seemed incredible, there is, and must be, *ex necessitate*, a large amount of microscope-power running absolutely to waste for want of some definite scheme of investigation or choice of subject to be studied. To all, then, who are tired of examining a limited series of slides over and over again, Dr. Cooke's work addresses itself, and introduces them to a world of wonders—only, in a majority of cases, too close at hand—which will furnish an inexhaustible storehouse of work for the student. Whether we consider the colouring, the form (in certain cases quasi-geometrical), the life-history and mode of reproduction of these minute and humble forms of vegetable life, or the important part they play in the economy of nature, we cannot fail to be struck with the vast field for research which their structure and formation present. That Dr. Cooke's capital little book has supplied a distinct want we have evidence in the fact that it is the fifth edition that lies before us. His language is always plain and intelligible, and his descriptions of the various lowly fungi of which he treats are admirably illustrated by no less than 269 figures drawn and coloured after nature by Mr. Sowerby. Every possessor of a microscope should have this book on his shelves.

A Synopsis of Elementary Results in Pure Mathematics. By G. S. CARR, M.A. (London: Francis Hodgson. Cambridge: Macmillan & Bowes. 1886.)—The author, or compiler, of this wonderful monument of patient industry may well be congratulated on having produced a work of perennial value to the student. Containing no less than six thousand propositions, formulæ, and methods of analysis, with abridged demonstrations, it ranges over the entire field of pure mathematics, and embodies every useful proposition in the various branches of which it treats. The student reading for his examination, alike with the advanced mathematician, will find Mr. Carr's volume simply invaluable as a work of reference. Practically everything that he has met with in his reading he will here find succinctly explained and illustrated by an appropriate demonstration. It contains the essence of a very large number of works indeed, and to all who have previously studied any of the very various subjects with which it deals, it will almost stand in the place of an extensive collection of books. The figures are models of clearness, and the index is exhaustive. It is, in fine, emphatically a work without which no mathematical library can be complete.

Proceedings of the Society for Psychical Research. May 1887. (London: Trübner & Co.)—In the year 1884 an attempt was made to get this magazine to advertise a person named Eglinton, a slate-writer; first by sending a book to us for review, and then by a frantic effort of a certain "spiritualistic" journal to provoke us into a discussion. Both, of course, failed, and Eglinton had to announce his tricks through some other medium. One of the most interesting things—among many—in the May part of the *Proceedings of the Society for Psychical Research* is a description of certain experiments, and a discussion of their results, which throw the strongest possible light on the way in which this Eglinton deludes the fatuous creatures who resort to him as a means of communication with the other world. We would urge every one interested in this form of imposture to obtain the number of the Society's *Proceedings* now before us straightway, and to read the papers by Professor Carvill Lewis and Messrs. Hodgson and Davey with all the care and attention he can bestow upon them. They will be found amply to repay the trouble. Nor, as we have previously intimated, will the remainder of the number be found destitute of interest, containing, as it does, the presidential address of Professor Balfour Stewart and several essays by Messrs. Myers and Gurney. The weakest part of the "psychical" case, as expounded in the volume on our table, is, as it seems to us, that founded on the observation of so-called hypnotic phenomena; as, within our own experience, there is no class of performance which so readily lends itself to impostures as this does, or in which such imposture is so difficult to detect.

Geology of Northumberland and Durham. By G. A. Lebour, M.A., F.G.S. (Newcastle-upon-Tyne: Lambert & Co. 1886.)—Originally prepared as a text-book for Professor Lebour's Class of Geological Surveying, his work has expanded in this, its second, edition into a compendium of the geology of our two northernmost English counties. Himself apparently more especially a physical geologist, Mr. Lebour furnishes a quantity of information with reference to the palæontographical character of the strata which he describes, in the shape of numerous pretty complete tables of the fossils found in them. Five plates and seventeen woodcuts in the text sufficiently illustrate a volume which will certainly be found valuable by all scientific visitors to Northumberland and Durham, and by others who may wish to learn all that is known as to the geological structure of those counties.

On Forecasting the Weather. By B. G. Jenkins. (F. Hayez, Brussels. 1887.)—Unless our memory is more treacherous than usual, the last time we met Mr. Jenkins in print was on the announcement of his having found a celestial mare's-nest in connection with a luminous spot on the planet Mercury in transit. His latest discovery in equine nidification takes the form of a revelation that the weather has a sixty-two year period, and that this is strictly referable to a lunar cycle of identical duration, at the end of which he asserts the moon is in apogee, and perigee in new and full, &c., at the same dates that she was sixty-two years ago. Now, *imprimis,* this is simply untrue; albeit what is asserted really happens at the end of fifty-four years *plus* thirty-two or thirty-three days. Proceeding, however, we find the discrepancies between Mr. Jenkins's years of comparison disposed of on the assumption of "inequalities in the moon's daily motion"!!! Furthermore, Mr. Jenkins's months are calculable from a certain time after apogee to a certain time after the succeeding apogee; while the greatest amount of rain falls, as he asserts, about three months after the nearest approach of the moon to the Earth! We learn with unbounded surprise that all this stuff has been printed at the cost of the Royal Academy of Belgium, "after being examined by an astronomical commission." We are most curious to know the names of the astronomers (?) who sanctioned such publication.

Transit Tables for 1887. By Latimer Clark, F.R.A.S., M.I.C.E. (London and New York: E. & F. N. Spon. 1887.)—Once more we greet with sincere gratification the appearance of Mr. Latimer Clark's excellent and most useful little volume of tables, indicating as its annual appearance does the existence of an extensive public interest in the question of obtaining rigidly accurate time, independently of local clocks and other imperfect methods of ascertaining it. Furnished with one of the cheap and efficient transit instruments of Mr. Clark's invention, and the volume before us, anyone and everyone, be his position the most isolated possible, may determine his time within a fraction of a second—a boon only to be realised by those who have once enjoyed it. How it is to be obtained may be learned from Mr. Clark's full and instructive preface.

Alpine Winter in its Medical Aspects. By A. Tucker Wise, M.D., L.R.C.P., &c. (London: J. & A. Churchill. 1886.)—The favourable notice of the first edition of Dr. Tucker Wise's book, which we felt it our duty to give on p. 346 of our Sixth Volume, is justified by the appearance already of its third. It certainly deserves the careful study of all afflicted with lung disease.

Household Health. By B. W. Richardson, M.D. (London: Society for Promoting Christian Knowledge. 1886.)—A book to be commended to every occupier of a house, be his social rank what it may. The extraordinarily low price at which Dr. Richardson's work is published renders it eminently suitable for distribution among a class whose neglect of household hygiene is a chronic source of danger in large towns and cities.

THE FACE OF THE SKY FOR SEPTEMBER.

SPOTS in varying numbers, though rarely of any considerable size, continue to appear from time to time on the sun's disc. Towards the end of September the zodiacal light may be seen in the east before sunrise. The aspect of the night sky is shown on Map IX. of "The Stars in their Seasons." Mercury is a morning star at the beginning of the month, but passes behind the sun on the 10th, and subsequently becomes an evening star. He is very indifferently placed for the observer throughout September. Venus begins September as an evening star, but comes into inferior conjunction with the sun on the 21st. At and about this date she is a glorious object in the telescope, and particular attention should be paid by the observer to the visibility, or non-visibility of her dark limb. The night sky, in so far as the planets are concerned, is an absolute blank, the whole of those exterior to the earth being, for the observer's purpose, invisible. The moon is full at 11h. 12·7m. A.M. on the 2nd, enters her last quarter at 3h. 3·2m. in the afternoon of the 10th, is new at 1h. 59·8m. P.M. on the 17th, and enters her first quarter at 5h. 3·9m. in the early morning of the 24th. The moon will occult six fixed stars during the present month. The first is the 6th magnitude one, 29 Sagittarii, which will disappear at the moon's dark limb on the 24th, at 10h. 43m. P.M., at an angle of 180° from her vertex. She will have set ere it reappears at her bright limb. On the 25th Sagittarii, a star of the 5th magnitude, will disappear at the dark limb at 11h. 27m., at a vertical angle of 125°; but, as in the previous case, the moon will have set prior to its reappearance. On the 26th B.A.C. 7053, of the $5\frac{1}{2}$th magnitude, will disappear at the dark limb of the moon at 5h. 35m. P.M., at an angle from her vertex of 73°. It will reappear at her bright limb at 6h. 55m. P.M., at an angle of 270° from her vertex. One minute after its disappearance, another star of the $5\frac{1}{2}$th magnitude, *o* Capricorni, will disappear at exactly the same spot in the lunar limb, as B.A.C. 7053 itself, reappearing simultaneously with it at the bright limb, at a vertical angle of 269°. On the same night, one minute after midnight, *v* Capricorni, also of the $5\frac{1}{2}$th magnitude, will disappear at the dark limb at a vertical angle of 93°; but the reappearance will take place below our horizon. Finally, on the 28th, 42 Aquarii, a 6th magnitude star, will disappear at the dark limb of the moon at 10h. 14m. P.M., at an angle of 65° from her vertex. Its reappearance will happen at 11h. 1m. P.M. at her bright limb, at a vertical angle of 1°. At noon to-day the moon is in Aquarius, through which constellation she is travelling until 9 A.M. on the 3rd, when she enters Pisces ("The Seasons Pictured," plate xxii.). Here she continues until 10h. A.M. on the 4th, when she passes into Cetus. Skirting the confines of the two constellations, she re-emerges in Pisces at noon on the 5th, only, however, to re-enter Cetus at 11h. A.M. on the 6th. She finally quits Cetus at 7h. A.M. on the 7th, and crosses into Aries ("The Seasons Pictured," plate xxiii.). At 10 A.M. on the 8th she leaves Aries for Taurus, and is passing through it until 8h. A.M. on the 11th, at which hour she arrives at the northern prolongation of Orion. It takes her until 7 o'clock the same evening to cross this, and she then comes out in Gemini. By 1 P.M. on the 13th she has traversed the last-named constellation and passed into Cancer ("The Seasons Pictured," plate xxiv.). Her journey through Cancer is completed by 1h. A.M. on the 15th, when she enters Leo. Here she remains until 10h. 30m. A.M. on the 17th, at which hour she quits Leo for Virgo ("The Seasons Pictured," plate xxv.), her journey through which terminates at 5h. 30m. A.M. on the 20th, when she crosses into Libra ("The Seasons Pictured," plate xxvi.). As she travels through Libra she arrives at midnight on the 21st on the western edge of the narrow northern spike of Scorpio. Eight and a half hours later she has crossed this and entered Ophiuchus. She leaves Ophiuchus at 1h. A.M. on the 24th for Sagittarius, and Sagittarius in turn for Capricornus at 9h. 30m. A.M. on the 26th ("The Seasons Pictured," plate xxi.). At 11h. A.M. on the 28th she crosses the boundary into Aquarius. Her passage through Aquarius is completed by 1h. P.M. on the 30th, and she then, for the second time this month, passes into Pisces ("The Seasons Pictured," plate xxii.). She is still in Pisces at midnight on the 30th.

Our Chess Column.

BY "MEPHISTO."

THE great International Chess Tournament, the fifth congress of the German Chess Association, was begun at Frankfürt on July 18, and concluded on August 2 with the victory of Captain Mackenzie, who reached the fine score of 15 wins out of 20 games played. This result is all the more creditable as this tournament, with twenty-one competitors, was the largest on record, and, on the whole, it contained as strong a lot of players as ever met together to engage in a tournament. Blackburne tied for second place—always a creditable position—he having an equal score with Weiss, of Vienna, namely, $13\frac{1}{2}$ each. No other English competitor took a prize. Not many novelties have been displayed in the treatment of the openings. The Ruy Lopez and the Queen's Pawn opening have had an undue share in the *début*. The second player in the Queen's gambit declined, *i.e.*, P to Q4, followed by P to QB4, &c., have several times defended successfully with P to QB3, and have eschewed playing P to QB4. The Sicilian defence has proved itself entirely wanting, and will probably not be resorted to again by modern players. The normal form of the King's gambit has been played with success by Metger against Englisch, and has apparently been discarded without sufficient reason. The Vienna game has on more than one occasion not yielded a satisfactory result to the first player on persisting in playing 3. P to KB4 after Black played 2. Kt to KB3. Finally, we may mention that Tarrasch obtained a good game by defending the Steinitz gambit played against him by Burn with 4. Q to R5 and 5. P to KKt4.

Appended are a few specimens of the play at the tournament.

Game played in the third round between the first prize-winner and Dr. Tarrasch, who divided fifth and sixth prizes with Professor Berger:—

SICILIAN DEFENCE.

WHITE. Mackenzie.	BLACK. Tarrasch.
1. P to K4	P to QB4

(See introduction for remark on Sicilian Defence.)

WHITE. Mackenzie.	BLACK. Tarrasch.
2. Kt to QB3	Kt to QB3
3. Kt to B3	P to KKt3
4. P to Q4	P × P
5. Kt × P	B to Kt2
6. B to K3	P to Q3
7. B to QKt5	

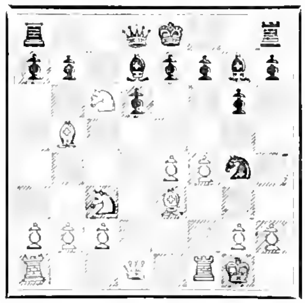
(The B is better placed on K2.)

WHITE. Mackenzie.	BLACK. Tarrasch.
7.	B to Q2
8. Castles	Kt to B3
9. P to B4	

(P to KR3 was necessary to present Kt to Kt5.)

WHITE. Mackenzie.	BLACK. Tarrasch.
9.	Kt to KKt5 !
10. Kt × Kt	

BLACK.



WHITE.

WHITE. Mackenzie.	BLACK. Tarrasch.
10.	P × Kt

(Kt × B instead would have led to exchanges of pieces not disadvantageous to Black as second player.)

WHITE. Mackenzie.	BLACK. Tarrasch.
11. B to Q4	P to K4

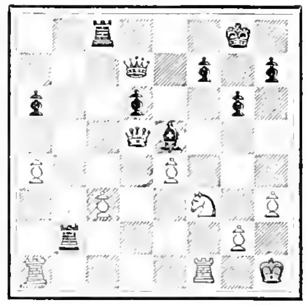
(Of course Black played for winning a piece. For a safe end-game he might have played B × B. 11. Q × B, Q to Kt3, &c.)

WHITE. Mackenzie.	BLACK. Tarrasch.
12. P × P	P × B

(An oversight. Black should have played P × P instead. Then if 13. B to B5, B to Bsq best, and Black should win.)

WHITE. Mackenzie.	BLACK. Tarrasch.
13. P to K6 !	Kt to K4
14 P × B (ch)	Q × P
15. B × Kt	B × B
16. Q to Q5	Castles KR
17. Kt × P	QR to Ktsq
18. P to QR4	P to QR3
19. Kt to Q4	Q to R2
20. P to B3	R × P
21. K to Rsq	Q to Q2
22. P to R3	R to Bsq
23. Kt to B3	

BLACK.



WHITE.

(Making a dash for an attack.)

WHITE. Mackenzie.	BLACK. Tarrasch.
23.	B × P
24. Kt to Kt5	R to B4
25. R × P	R × Q
26. R × Q	R(Q4) to Q7
27. R to QBsq	R(Q7)QB7
28. R to KKtsq	B to Q5

(A blunder. Any other move would have done.)

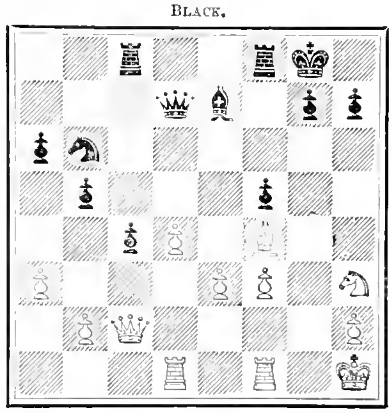
WHITE. Mackenzie.	BLACK. Tarrasch.
29. R to Q8 (ch)	K to Kt2
30. Kt to K6 (ch)	Resigns

The following game was played on the 5th round, and may serve as a fine illustration of the rapid and skilful mode of attack adopted by Blackburne. He continued as follows:—

Position after Black's twenty-second move.

TAUBENHAUS.

BLACK.



WHITE.

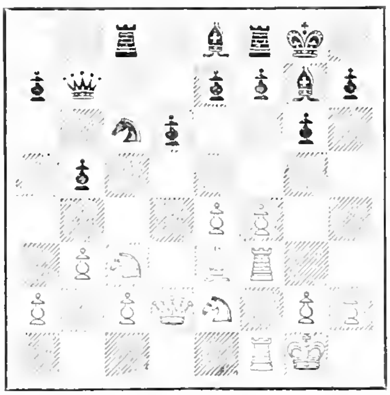
BLACKBURNE.

White.	Black.
23. R to KKtsq	B to B3
24. R to Kt3	Kt to Q4
25. QR to KKtsq	R to KB2
26. B to R6	K to Rsq
27. Q to Kt2	P to B3
(R to Ksq seemed preferable.)	
28. P × P	R × P
29. Kt to Kt5	B × Kt
(If R to K2 White may play Kt to K6.)	
30. R × B	R to B2
31. Q to Kt3	P to B5
32. Q to R4	P to Kt3

White.	Black.
33. P to K4	Kt to K6
(Kt to K2 was better.)	
34. R × KtP !	P × R
35. B × P (ch)	K to Ktsq
36. B to K5 !	R to Kt2
37. Q to R6 !	R to B3
38. Q × Kt	
(All very fine play: if R to R2 then 39. P to Q5.)	
38.	Q to KB2
39. P to Q5	R to B7
40. B × R	Q × B
41. Q to B1 and White won.	

Position resulting out of a Sicilian defence played at Frankfürt:—

Gottschall.
Black.



White.
Gunsberg.

The game terminated as follows:—

White.	Black.
R to R3	P to Kt5
Kt to Q5	P to K3
P to B5	P × Kt
P to B6	B to Rsq
B to Q4	B to Q2
R to R4	P to R4
(If Kt × B White wins by Q to R6.)	
R × P	B to Kt5
R × B (ch) and wins.	

Our Whist Column.

By "Five of Clubs."

THE DISCARD IN ITS SUIT-DIRECTIVE ASPECT.*

In three letters contributed to recent numbers of *The Field*, General Drayson dealt with the "suit-directive" aspect of the question of the discard, with the apparent object of contributing his quota to the modern industry of importing the greatest possible number of cut-and-dried rules into the practice of the game of whist. He considers four cases, of which two are general and two are particular. In summarising the conditions which he discusses, we shall assume, once for all, that A and B are partners against Y and Z: that A is always the elder hand; and that the lead first described is the original lead of the game. His four cases, then, are as follow:—

1. (General.)—A leads trumps. Z wins, and returns the trump; Y is obliged to discard. Ought Y's discard to be from his strong or from his weak suit?

2. (General.)—A leads trumps. Z wins and returns the trump. B is obliged to discard. Ought B to discard from his strong or from his weak suit?

3. (Particular.)—A leads trumps (say clubs), and the trumps are evidently with Y and Z. Y holds spade 8, 7, 5, 4, 3; diamond A, Kg; club 9, 6; heart, 9, 8, 3, 2. On the third round of clubs Y must discard. Which card ought he to throw away?

4. (Particular.)—A leads trumps (say clubs), and trumps are declared against Y and Z. Y holds spade A, Kg, Q; club 7, 6; diamond A, Kg Q; heart 7, 6, 5, 4, 3. On the third round of trumps Y must discard. Which card ought he to throw away?

To his general questions General Drayson replies that, in the first case, Z has returned A's adverse trump lead. Hence trumps are not declared against the co-partnership of Y and Z. Therefore Y ought to discard from his weak suit. But, in the second case, Z has returned A's trump lead up to B's weakness in trumps. Therefore A is placed in the position of having to fight single-handed against the combined trump strength of the adverse co-partnership. Therefore B ought to discard from his strong suit. These sentences do not give the exact terms in which General Drayson formulates the principles by which he regulates his practice; but they convey a clear idea as to the hard-and-fast system which he wishes to establish in order to minimise the trouble of thinking about the varying conditions of play as they arise. In its broader aspect, of course, we do not object to General Drayson's idea. For there can be no doubt that it is desirable to lay down general principles by which to regulate the protective discard. But for all practical purposes the rule given by Mathews at the beginning of the century is amply sufficient:—"If weak in trumps, keep guard on your adversaries' suits: if strong, throw away from them." Besides, from the terms in which General Drayson writes, it is pretty plain that he is one of the very numerous believers in the fallacy that under all circumstances length of plain suit means strength. It cannot be too often repeated, however, that in themselves five or six minor cards of a plain suit are an element of weakness, and that the conversion of such weakness into strength requires (1) that the holder should have opportunities of clearing the suit, and (2) that he or his partner should either be protected in trumps or else that one of them should have either the command of the adversaries' plain suits or at least the power of obstructing their establishment.

With regard to the first of General Drayson's particular cases, it is clear that to the third round of trumps Y cannot discard either his ace or his king of diamonds. He must evidently throw away either one of his five minor spades or one of his four minor hearts; and probably, in the majority of cases, his best course would be to part with a spade—the chance of ultimately making the nine of hearts being somewhat better than the chance of ultimately making the eight of spades. In General Drayson's fourth case there can be no room for doubt at all. Y must throw away one of his small hearts, retaining the complete command of diamonds and of spades; for his cards in both those suits are good of themselves against anything but trumps, while his small hearts are valueless so long as higher hearts are held by the other players. Since tricks are to be made, what can it matter whether the making of one of them be the prompt work of the diamond ace or the deferred privilege of the heart seven?

General Drayson does not think it necessary to supply any answers to his own questions. But he proceeds to remark that he has met several whist-players who claim that, in dealing with the difficulty of the protective discard, the only thing to be borne in mind is whether the original trump lead was by partner or by adversaries. He gives the following illustration:—Being Y, he held spades, 3 small; diamonds, 2 small; club A, Kg, Q, 3, 2; and hearts (trumps), 3 small. Nothing is said about the score. The play was that A led tierce major in trumps, and that B failed on the third round. Then A led the king of spades, which Z won with the ace. Next Z led the knave of hearts, to which Y discarded a diamond. Whereupon Z led a diamond, finding the complete command both of spades and of diamonds with his adversaries; the ultimate result being that Y made only one trick in clubs. General Drayson maintains, and rightly maintains, that under the circumstances stated, Z ought not to have led a diamond. It is clear that Z not only had a very bad hand, but also that he knew that the strength of the spade suit lay against him. Under such circumstances his play in drawing A's losing trump was very much of a leap in the dark. Its only justification would have been that, being obliged to rely for defence on Y's hand, he played the winning trump in order to ascertain Y's strong suit by inviting him to throw away a losing card at a time when the command of trumps was in his favour. No wooden-headed rules—"apt for blockheads," as "Mogul" said the other day—would have sufficed to supply such a player as Z with the sense (in which General Drayson shows him to be quite deficient) of the importance of noting the time at which, and the circumstances under which, Y was

* From the *Australasian*.

forced to discard. Z, apparently, is a player who draws an adverse losing trump merely because he has got the idea into his head that it is his duty to prevent its ever winning a trick; but at the same time, without reflecting that if he has not a clear impression as to what he ought to do next, it would be better to make his leap in the dark before he parts with the trump command for the mere pleasure of disarming an adversary.

It is absurd, then, to attempt, as General Drayson has done, to lay down canons of play to meet circumstances such as he contemplates in his illustrative case. In framing conventional rules it is impossible to make sufficient allowance for the "personal equation" of the player by whom they are to be applied.

General Drayson suggests, however, that when a player, who holds five minor cards of one plain suit, together with commanding but numerically short strength in the other two, is compelled to part with one of the former, the proper thing for him to do is to throw away an unnecessarily high card. This is to be a new convention—to be known as the convention of "change your suit from the suit which your partner is now throwing away." It is a development, according to its ingenious proposer, of the "call for trumps"—being intended as a call, when trumps have been drawn, for one or other of the remaining plain suits—the one being clearly indicated in the preceding illustrative example, as necessarily being the club. It is now nearly three years since General Drayson invited "progressive" whist-players to turn their attention to his idea of adding the "plain-suit Peter" to the recognised conventions of the game, and he remarks somewhat plaintively, that, hitherto, his proposition has neither been examined nor practised. He thinks, however, that now that "American leads" have been fairly worked out the time is ripe for further attempts to tamper with that portion of whist in which—despite of all the "extensions" that have been bitherto based on the absurd assumption that a principle is something of an elastic character—the difficulties of the discard still survive to tax the judgment of the whist-player. We are glad, however, to note that, for the moment, at all events, the general's proposal has a very fair chance of being quietly ignored by the London whist-playing world.

There are several reasons for drawing this deduction. In the first place, it is to be observed that in KNOWLEDGE, which, with the exception of the *Field*, is the only journal in London in which whist questions are regularly discussed, "Five of Clubs" (Mr. Richard A. Proctor) no longer maintains towards the modern conventions the attitude of unquestioning acceptance to which he committed himself in the early days of his whist editorship. Moreover, not content with modifying his own views on conventional play, he has published a series of articles from "Mogul's" pen, of which the first opened with the argument that the quality which gives to whist its greatest charm is that it exercises the faculty of reasoning from the known to the unknown. Hence the introduction into the game of signals which convey positive information cannot but be regarded as tending to make whist less scientific, and consequently, to lower its character. It follows, then, that Pole outrages common sense when he calls modern whist, as compared with the whist of Mathews and Deschapelles, the "scientific" game. For, in point of fact, modern whist is only the old and really scientific game, *plus* certain "dodges for giving information which are known as signals."* These are purely mechanical. Therefore, they are "unscientific." For the very essence of a signal is that, by virtue of a previous convention, it conveys certain definite information. Moreover, as a matter of fact, so entirely does the meaning of an arbitrary signal depend upon a prior understanding, that two of the modern signals were once regarded as conveying different information from that which they now give. If the matter be examined carefully it will be found that one of two things must be true. Either supposing all the players at a table to be possessed of equal skill, the adoption of signals gives no advantage to any one of them over any other; or else if better players are pitted against worse, the latter ought to have a handicap in their favour. In the latter case, since, as a rule, odds are not given at the whist-table, signals ought to be "squelched" without further argument, while in the former there is no reason for introducing them. Why not be content, then, with leaving well enough alone?

Such outspoken language as this is sufficient indication that at length efforts are being made to open the eyes of the London whist-playing world to the fallacies of the reasoning by which Cavendish has succeeded for a long series of years in persuading himself and in persuading many disciples that whist is improved by the introduction of arbitrary and purely mechanical signals. According to "Mogul," the secret of his success is that "the inferior players, always constituting a majority," have been only too glad to avail themselves of anything "which, apparently, they can use as well" as the most gifted and the most skilful. To this is to be added the obvious consideration that whenever any fad creeps in among the members of a whist-circle, the non-faddists must either make the best of the situation, or else they must resign themselves to the prospect of going without their customary rubber. There remains, however, a third fact of even greater significance than either of the two we have already mentioned. Cavendish, whom "Mogul" dubs the "arch-inventor of signals," lost no time in declaring his opinion that "the difficulties of the discard cannot be satisfactorily disposed of" by General Drayson's "cast-iron rules." Nor is this only an indication that Cavendish is annoyed at finding that another convention-monger has been poaching on his own pet and peculiar manor. For the fact is, says Cavendish, that "the discard is often a matter of judgment. Judgment cannot be taught by letters in the *Field*, nor by whist-books, however practical." No doubt the existence of spite in measurable quantity may be inferred from the fact that in the *Field* the "practical" of the immediately preceding sentence is printed with a capital "P." But the whist world is concerned only with Cavendish's change of front on the convention question, and need not trouble itself about the exact amount of irritation of temper with which he has begun to write off the six million and odd square inches of pica type which embody his long-continued efforts to knock the brains out of his favourite game. Moreover, sudden as has been his conversion, there need be little doubt that, although it seems to have come with a rush, it will prove to be thorough and complete: for already, in one paragraph of his criticism of General Drayson's suggestions, he says that, "of all modern whist developments, the discard from the strong suit is the one about the value and soundness of which no reasonable doubt can exist." This statement, by the way, "Mogul" absolutely contradicts in the second of his KNOWLEDGE articles. The only objection to the modern rule, continues Cavendish, is that to apply it properly "requires the keenest whist judgment." In another paragraph Cavendish remarks that "people who follow the rule of discarding from the strong suit because the adversary has started a trump lead are not worthy of being called whist-players." Nor is this all. For in a third paragraph he, the greatest sinner alive in that particular respect, remarks that "people talk and write about whist as though it could be played by a machine." To which he adds the naïve confession that "no doubt there are many players who regulate their plans by 'book alone,' but they never rise above mediocrity." From the class of writers, however, whom Cavendish has in his mind, he expressly exempts General Drayson by name, thus gracefully preparing for the new era in his own history as a writer on whist, in which he himself will deserve to be paid the same compliment. Nor is there anything surprising in the suddenness of his apparent conversion from the familiar errors of his ways. It is quite in accordance with the known peculiarities of his natural temperament. For, as Pembridge humorously remarks in the "Decline and Fall of Whist," "the constitution of whist and the constitution of our beloved country are both at the mercy of a grand old man of exuberant verbosity. Each [of these] is able in some extraordinary way to persuade himself that the side of any question on which he happens to be looking is not only the right side, but that it positively has no other; [and this, too,] in spite of the fact that in previous stages of his existence he has himself both recognised and vehemently supported that other side."

* There is more of true whist science in "Mathews on Whist" than in all the modern treatises put together, excluding what has been derived from Mathews.—"FIVE OF CLUBS."

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ILLUSTRATED MAGAZINE
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SCIENCE, LITERATURE, & ART

LONDON: OCTOBER 1, 1887.

HUMAN LIFE.

AMONG the most perplexing problems relating to humanity must be included the strange contrast between what men aim at in regard to human life, and what would result if their efforts were successful. It is an accepted principle of philanthropy that human life should be carefully nurtured in all available ways; it is a recognised test of good government and of satisfactory progress in civilisation that population should increase, and that sickness, pestilence, famine, war, and all death-dealing agencies should diminish. But suppose the efforts of philanthropy, political economy, and science in these directions were successful, suppose that in all the chief nations and among all the principal races the rate of the growth of population were increased, or even maintained unchanged, for but a few centuries—the merest second in the history of the world or even of races—what must inevitably happen ere long? Would human happiness be increased? Would, even in the long run, human life be extended? On the contrary, utter and irretrievable misery would ensue. The human race would deteriorate; nay, its growth and development suddenly ceasing, it would run considerable risk of coming to an untimely end.

I am not an admirer of Mr. Ruskin's philosophy—great though he may be as an art critic and as a rhetorician. I consider, indeed, the attention it has received a most depressing feature of the age, seeing that there is no connection between art and philosophy, or between eloquence and reasoning, and Mr. Ruskin's philosophy is shallow, his reasoning naught. Yet, underlying its absurdly fervid grandiloquence, the following bit of fine writing contains (or rather conceals) a most important truth. "Loss of life!" says the eminent art critic; "by the ship overwhelmed in the river, shattered on the sea; by the mine's blast, the earthquake's burial, you mourn for the multitude slain. You cheer the lifeboat's crew; you hear with praise and joy of the rescue of one still breathing body more at the pit's mouth; and all the while, for one soul that is saved from the momentary passing away (according to your creed to be with its God)"—[though as to this, Mr. Ruskin, "you can't quite always generally tell;" the soul thus saved may have—may not, in fact, have done so well]—"the lost souls, locked in their polluted flesh, haunt with worse than ghosts the shadows of your churches, and the corners of your streets; and your weary children watch, with no memory of Jerusalem, and no hope of return from *their* captivity, the weltering to the sea of your waters of Babylon."

If the thought underlying this turgid strain is just, if the saving of life cannot be regarded as always an unmixed blessing—and who can doubt this?—how much more obvious should it be that the numerical increase in the number of the living may become the reverse of a blessing, indeed little better than an unmixed curse, to the whole human race.

Before me lies a statistical record, from which I learn that in England, despite emigration and widespread pauperism (with attendant high mortality), the population, during the last twenty years, has increased at the rate of $1\frac{1}{2}$ per cent. per annum, with every sign of growing at the same rate, or even at an increasing rate, for many years to come. Admirable country! excellent administration! encouraging outlook for the future! At this rate the population of the old country may be expected to increase tenfold in about 154 years. One rather wonders how the question of wages, already pressing rather seriously upon the English people because of undue numbers, and consequently too close competition (over-production of workers, in fact), will appear when the encouraging development of the population of England has gone on to this extent. Putting the present population of England at about 30,000,000, the population in 2031 will be 300,000,000, unless the encouraging growth of numbers should in some way be interrupted.

But let us look a little farther ahead. England is not so young a country but that we can look back over 621 years of her history, to the year 1256, when the first of our English Kings to celebrate a jubilee, Henry III., the rather mild son of the not exemplary John, had been fifty years on the throne. During the interval which has elapsed since then a great deal has taken place in England, but England has not grown in population at the rate at which she is growing now. For if she had that would mean that her population in 1256 amounted only to 3,000 persons, all told; and Cœur de Lion, Henry III.'s uncle, used up ten times that number at least in fighting only. It would seem, then, as though the population of England had not only been growing, but growing at an increasing rate—a result, indeed, which follows still more obviously if the actual population in successive centuries, from the time of William the Conqueror onwards until now, be considered. We may then at least look forward for a continual increase at the rate of $1\frac{1}{2}$ per cent. during the next six centuries. What, then, will be the pleasing state of affairs in England in the year 2500 or thereabouts? The population increasing tenfold in 154 or 155 years, will by the year 2500 have increased 10,000-fold, or will amount to 300,000,000,000, exceeding some 200 times the probable present population of the whole earth. There will then be about six square feet of space for each inhabitant of England; and by that time, we may assume, the three-acres-and-a-cow idea will have had to be given up by the statesmen swaying those 300,000,000,000 "under Britain's royal sceptre then." As for the "imperial sceptre" with its sway over the colonies and subject populations of Great Britain, it would be difficult to say how it would work, even if the 9,000,000 of square miles forming Great Britain's present empire should by that time have increased to 20,000,000.

But the future of the United States, viewed in the same way, is not less "encouraging," according to one view, or less appalling according to the other. The population of America doubles in about twenty years, or five times in a century, five doublings meaning a thirty-two-fold increase. In four centuries, at this rate, the increase of the population of the United States would be about a million-fold (thirty-two times thirty-two times thirty-two times thirty-two times), or the population would amount to sixty millions of millions, or thereabouts. This would be a population of about 16,000,000 per square mile, or 10,000,000 per square mile, assuming a fair absorption of surrounding territory, and 4,000,000 per square mile if the whole of North and

South America were available for the American population. About three-fourths of a square yard of surface would then be available for each inhabitant of the double continent. If the whole earth were peopled by these 60,000,000,000,000 Americans, there would be nearly three square yards of space for each person!

Of course we know that there is no likelihood of any race or nation increasing in population even at such rates as $1\frac{1}{2}$ per cent. for several centuries in succession. It is not because of any real danger (or hope) that England, for example, which now boasts of this rate of increase during a quarter of a century, or the United States, which boasts of a much greater rate of increase during a much longer time, will continue to grow at this rate, that I have presented the above startling figures. But it is worth while to consider a little how far we are entitled to "rejoice and be glad" over what we regard as progress, when it is clear that the progress cannot possibly continue without ruinous results for the whole human race.

Especially startling, or rather oppressive, become the thoughts suggested by this so-called progress when we remember how much more rapid is the progress of exhaustion of our earth's accumulated stores on which the growing population of the earth in part depends.

It might or might not be possible for the present population of the earth to live, as of old the inhabitants of earth were content to live, upon the annual produce of the earth —on the earth's income, not on her capital. But assuredly whether this might be done or not, it is not done at present. Year after year the buried stores of life, for that is really what they should be called, are being brought in greater and greater quantities to the surface, and used to supply the human race with much more than the necessities of life.

In two States of the Union alone one kind of accumulated earth life, the petroleum and natural gas store, has been so rapidly used up that within one generation alone stores which were millions of years accumulating will have been almost wholly exhausted.

In Great Britain 150,000,000 tons of coal are yearly brought to the pit's mouth, though it has become clear that the effective supply will be exhausted at the present rate of consumption in the course of ten or twelve generations at the outside.

The forests of the earth, at any rate in all civilised countries, are being steadily destroyed, though it would be quite possible so to arrange matters that the supply used each year should be replaced by new growth during the same time.

Like a spendthrift, the human race of to-day, boasting itself "the heir of all the ages" in intelligence, is consuming at a rate fully one-hundred fold beyond what is just the supplies which, as heir of all the geological æons, it has received—in trust partly for future generations.

That men should rejoice when statistical records attest the steady growth of all civilised nations in population, at the very time that the stores of the earth are being wastefully consumed, is as though the father of a growing family should rejoice at each addition to his family circle, at the very time when each year's accounts told him that his means of providing for them were rapidly growing less, and exhaustion was imminently threatened.

I have occasion often, as a student of astronomy, to touch on the gradual dying out of the earth's vitality, and to descant on the limited nature of the sun's supply of life-giving energy. I remind my audiences in lectures, and my readers in books and essays, that as the moon has died so must the earth hereafter die; and that as among the stars (those other suns than ours) we find suns that are manifestly fading in lustre and even evidence of orbs which, though once lustrous, are now dark and dead, so must our sun one day lose his light and heat, and with them his power of sustaining life in the worlds circling around him. But I doubt whether the inhabitants of our world need be very much interested in the future darkness of the sun or in the coming decay and death of the earth. The human race is taking excellent care that its duration shall not extend to either of those dismal times (whichever of them may be the first to come). Millions of years probably before the sun is dark, millions of years before our earth is dead, the civilised human race will have exhausted all that it has to live on, and will have come to an end through sheer inanition.

No discovery of new scientific appliances can avail to save our kind from this end, seeing that every such discovery would inevitably lead only to the more rapid exhaustion of the earth's garnered stores. Progress in civilisation, at least along the present lines, can only hasten the coming of the end. For civilisation, as at present understood, culture as at present alone appreciated, imply steady advance beyond the supply of mere necessities, beyond the mere support of life—the steady development of new wants, fresh pleasures, and greater luxury. Nothing could avail to make the increase of life, which so many contemplate with satisfaction, a real gain, or even to justify it, but some such change in the ways of the human race as Cornaro adopted for his own individual habit of life. When he found that he was exhausting the very springs of life, wasting the stored-up constitutional energies of his frame by unduly luxurious living, he wisely changed his way of living to what his friends regarded as a foolishly abstemious regimen. Condemned by the unanimous voice of the physicians to death within two years, he so developed his vital energies that he lived for sixty-four years instead of two, attaining the ripe age of ninety-nine years before death claimed him. Moreover, whereas in the fulness of his youth and manhood life had been but as a burden to him, life during the last three-fifths of his time—for a quarter of a century beyond the four score years, when, the Psalmist says, life is but labour and sorrow—was to him well worth living, nay, full of satisfaction and delight.

The human race is at present certainly advancing with swift strides towards a very desolate condition, if not towards death. It is not getting very much satisfaction out of its wasteful and thoughtless manner of living. If a few optimists recognise promise of good, more among us pessimistically ask the doleful question, "Is life worth living?" The meliorists who, deploring the evil, still see hope of change to wiser ways are few and low-voiced. Not regimen, which is really needed, but recipe is chiefly suggested by short-sighted men (whom the world mistakes for philosophers) to improve this state of things. Philanthropy, communism, socialism, anarchy, in turn hold out promise of improvement. But in the meantime the stores of life, on which the vitality of the human race as such must depend, are being used up at such a rate that the time of final exhaustion lies within measurable distance. And the statistician boasts, because the records of birth rates and death rates show that the end must be even nearer (supposing no change should take place) than it would be if consumption went on no more quickly than it is already doing.

THE STEAMERS of the new American "Arrow Line" are to be constructed upon a new principle, and with a view to an estimated speed sufficient to make the voyage between New York and Liverpool in a little more than four days. The *Pocahontas* will be 540 feet long, will be provided with 1,060 water-tight compartments, 500 of which are to be below the water-line, and will have twenty boilers with engines of 27,986 horse-power, and capable of giving a speed of 22 knots an hour.

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

FEW phenomena in nature excite more astonishment than the great changes in form, habits, and capacities which many creatures visibly undergo in their passage from an infantile to an adult state. The transformations of insects must have been the first to attract attention, unless perhaps the change of the tadpole to the frog may have been recognised at a still earlier time. The higher animals have their transformations, but do not begin an independent existence until they are approximately finished. No one could hesitate in recognising a kitten as a small cat, or a puppy as a little dog, but without actually seeing it come to pass, no one would imagine that a caterpillar was an incipient butterfly, or a tadpole an incipient frog. As more and more is known of the ways of nature in the organic world, greater numbers of instances are noted in which early life stages are passed under such differences of aspect and organisation as to throw into confusion all ordinary notions of individualism and species. Are caterpillar, chrysalis, and butterfly one individual, or three? If we make a jump from the lower forms of life to man, we might consider continuation of self-consciousness as sufficient evidence that child, youth, and man were one and the same personality, but, how when, as occasionally happens, there is a breach in the continuity, the same man or woman exists in two or more distinct lives, each having peculiar and separate ideas, recollections, thoughts, emotions, and characters? If, when we study the highest life known to us, it seems that a man can be somebody else besides himself, we may the less wonder that in simpler organisms several apparently complete, distinct individualities may all successively belong to one and the same creature.

To constitute a species it used to be thought sufficient to show that a particular form, structure, and character were transmitted with considerable accuracy and precision through many generations, but in recent times a vast number of instances have been discovered in which the earlier and the later forms of the same creature are widely different. Some of the most remarkable cases have been detected amongst the infusoria through the researches of Drs. Dallinger and Drysdale. In one set of their very remarkable investigations they found that after keeping a maceration of cod's head for two or three months, vast numbers of a certain monad appeared as little egg-shaped bodies about $\frac{1}{3000}$ of an inch long, and provided with two long very slender whips. These multiplied rapidly by self-division, even the slender whips splitting in two. Here then, according to old notions, was a good species, but by incessant watching from hour to hour and week to week, a small triangular creature, swimming with four whips, which had not been suspected of any connection with the preceding animals, was found to be related to them in a most curious way. In the same field were some minute globes, showing nuclei, and gently waving a couple of whips, between which, after a period of quiescence, a small cone of sarcode was pushed out, and prolonged into a whip. By further processes this whip divided into two, the globe became oval and then split in two. The creatures thus formed each joined one of the first-mentioned animals, their bodies united and grew into a triangular object, with two pairs of whips. After a time the whips disappeared, and the object looked structureless and dead. Then an internal commotion ensued, and finally the thing burst and discharged swarms of the minutest dark granules, the germs of new generations.*

Discoveries of this kind not only gave an invaluable help to the Darwinian theory, but prepared all thoughtful microscopists to be very cautious in assuming infusorial objects to represent in an exclusive way anything that it would be either philosophical, or provisionally useful, to call a species, unless its entire life-history had been traced out.

A discovery by Mr. Saville Kent, and described in his great work on the Infusoria, has an interest similar to those of Dr. Dallinger. He found that a well-known and highly interesting infusoria, the *Actinophrys Sol*, was the final condition of an animal that had previously existed in two other forms, each differing widely from the other, and also from the last stage. Copying Mr. Kent's figures, we find (1) a pear-shaped bag, full of fine granules, with a large round vacuole near the thickest end, and a delicate whip springing from the thin one. This is not at all an uncommon form, and there is nothing in its appearance to indicate what it is likely to do, or how to distinguish it with any certainty from similar monads which will not undergo the same changes. The second figure looks like a distinct species. Instead of a smooth pear-shaped body, we see one roughened all over with large conical projections, but retaining the whip-like swimming organ (*flagellum*). Finally we have a delicate globe, with a vacuole, a nucleus, and an aureole of extremely fine rays springing from the internal

Fig. 1.

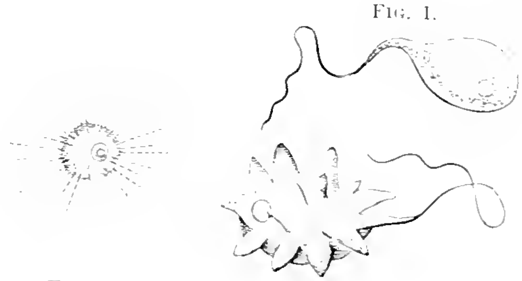


Fig. 3. Fig. 2.

sarcode mass. The pear-shaped form not only differs entirely in appearance from the actinophrys form, but the mode of life and organisation is changed. The first has a mouth into which it takes the food it can swim after and catch. The actinophrys waits till some appropriate object happens to touch one or more of its rays, when they seize it as a thread of glue might do, and draw it into the globe. The first appearance of the rays in the transition from form 2 to 3 was sudden, "like the bursting of a rocket, or other firework," and the creature retains the power of rapidly withdrawing or protruding these remarkable organs. It can also move them slowly, and they must be able to exercise a selecting power. If they were merely like sticky threads of glue, the whole creature would soon be buried under useless matter, as it lives in waters abounding in all kinds of particles which other creatures cause to stream in all directions by the movements of their cilia or flagella.

In the pear-shaped form we recognise nothing to remind us of the amœba, but the delicate rays of sarcode in the actinophrys form suggest relationship to various groups of creatures, with or without shells, who obtain their food by extending pseudopodia of sarcode, which, whether thicker or thinner, resemble in properties the prolongations of the naked amœba.

A stout form of stalked actinophrys (fig. 1) was found by

* See *Monthly Microscopical Journal* for 1873.

the writer to be common in a rockpool at Oddicombe Bay, Devon. It was provided with numerous rays in the form of long slender cones, terminating in sharp tips. The body was full of opaque particles, which prevented any structure being detected. Some of these objects kept their rays steadily and fully extended, others had drawn all or part

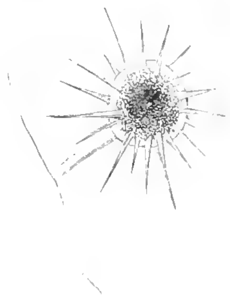


Fig. 1.

in and some of them did not preserve the globular shape of the body.

Watching one of the fully-expanded specimens at intervals for several hours I was rewarded by the sudden disappearance of all the rays. They vanished like light rays suddenly stopped by a screen. They soon came out again, but not so quickly. The animal evidently had full control of these processes, as on other occasions it withdrew them slowly, and sometimes varied the mode of protrusion, and also of retraction. These movements sometimes occurred symmetrically, all the rays moving in or out in uniform proportion. At other times some rays were fully retracted, while others were left partially out, and once the protrusion was quite irregular, some pseudopods being thrust across the others, deranging the pattern. This, perhaps, occurred when the creature was tired or lazy. I do not know whether any one has been fortunate enough to trace the life-history of this marine form, and I have seen no account of it. Mr. Gosse told me it was very common.

Under the name of *Actinomonas mirabilis*, Kent figures a singularly beautiful object rayed like a delicate actinophrys, standing upright upon an extremely slender and long stalk, and provided with a long whip, whose wavings and lashings would cause currents in the water, and thus bring food within its reach. He found this type in a jar of sea-water he had kept sundry creatures in for some weeks at Jersey. The rays were so close and fine that, under low powers they looked only like a haze surrounding the little globe, and required a magnification of 800 to display their true character. Kent's remark that the developmental and reproductive phenomena of this remarkable group (*Actinomonas*) have yet to be determined is probably still true, and leaves ample room for further interesting observations.

HEIGHT OF CLOUDS.

By Dr. R. F. Hutchinson.

Mussooree is one of our favourite hill-stations in the great Himalaya range, and is very easily reached by rail and road. Its position can be found by running the eye northwards (on any good map) from Agra on the Jumna. Its Mall is 6,000 feet, and its highest peak 7,026 feet above the sea. Below it, and 2,239 feet above the sea, is the wonderful valley of Dehra Dūn, 3,761 feet below the Mall. Of this more anon. No locality in the world can boast of such views as Mussooree. Stand on the Mall and look towards the plains of India, stretching away to the south and melting away in the purple distance; turn to the left, and you see the holy Ganges emerge from its rugged glacier-headed rift in the mighty Himalayas, struggle across the Dūn, burst through the barrier of the fossiliferous Siwálik hills at the sacred shrine of Hardwár, and then commence its long pilgrimage seawards. Just below Hardwár its right bank is tapped by the huge Ganges canal, a river in itself, 654 miles long, rejoining the parent stream at Cawnpore, after giving off 3,078 miles of distributaries. We distinctly see the canal, and Roorkee, the head-quarters of the Royal Engineers, with its enormous workshops on its left bank; and on a very clear day the church at Meerut has been recognised with a telescope. Turning to our right, we see the Jumna, glacier-born like the Ganges, crossing the Dūn, passing through the Siwálik range, and flowing away Delhi-wards, to join the Ganges at Allahabad. Let us climb one of the hilltops above the Mall, and what a sight meets our gaze! Snow-clad peak on peak and Alp on Alp stretching away, away to the north-west and south-east, and lost in the shimmering haze of their own exhalations—all giants varying from 24,000 to 26,000 feet high.

We can now revert to the subject of the paper, bearing in mind that the Mall is 3,761 feet above the Dūn level. On two occasions I witnessed the following glorious sight from the Mall. Below me lay a vast expanse of the purest flocculated cotton wool, entirely obscuring the plain of the Dūn; above me the pure cerulean. My sky was clear; that of the valley was obscured by cumulus. Aware of the chance that I now had, I looked about for landmarks whereby to measure the height of the stratum, and caught a house 900 feet below me, which was first touched by the woolly expanse, and therefore enveloped in fog. The figures, therefore, were clear—I was 6,000 feet above the sea level, and the valley below me was 2,239 feet above the sea, or 3,661 feet below me. But the cumulus stratum was 900 feet below me, and therefore 2,761 feet above the Dūn valley.

On another occasion, in the Rains, I was watching the ever-changing panorama of the Dūn, and caught sight of three thunderstorms slowly passing up the valley from the south-west, and apparently a mile apart, perhaps two. As they came abreast of me it was most interesting to watch the warfare of these storm-clouds. The dark nimbus was triangular, the apex downwards, shading off into the lines indicating rain, illuminated now and then by lightning flashes. The three storms were to me most businesslike in their movements and actions, and each seemed determined to assert its own dignity and importance. I watched them with interest and amusement, for while I was in sunshine and under a cloudless sky, each village over which each nimbus passed had its "heaven black with clouds and wind and great rain." The most remarkable fact regarding these vagrant nimbi was the constant fire of their artillery. One would have fancied that their electricity would have been exhausted soon after they left the far south-west, where I first detected them; but, on the contrary, they acquired strength as they went. Were they Leyden jars kept full as they went by the friction of their own movements?

Now, about the height of these storm clouds. As before stated, I was looking at them from an elevation of 3,761 feet above the Dūn valley, which is bounded to the south by the Siwálik hills, which rise to a height of 1,500 to 2,000 feet above the plain. I caught them passing a 1,500 feet peak, and they were below my line of vision, say by 300 feet roughly; then each nimbus would be 1,300 feet above the Dūn, while the cumulo-stratus was 2,761 feet above the valley. The average elevation of both phenomena would thus be 2,020 feet, which I believe to be correct. Apropos to cloud scenery. I am sure that, like myself, you have often from deck or shore stood entranced at the glorious and ever-changing piles of cumulus heaped on the horizon. That grand old sufferer, Job, was asked—"Can *any* understand the spreadings of the clouds?"

Can any one stand on the seashore, or on the deck of a ship at sea, and watch on the horizon the piled-up and ever-changing masses of snowy cumulus cloud, here assuming grotesque forms, there stretching away into illimitable vistas, as if forming approaches to "the plains of Heaven," without wondering at the mysterious character of those glorious dissolving views? Can any one watch uninterested the delicate and feathery forms of the cirrhus cloud, which every moment changes and assumes new beauties, apparently without an effort? Can any one gaze unmoved upon the dark and lowering nimbus as it approaches in solemn grandeur, its dark recesses lit up by fitful lightning flashes? Can any one watch the awful warfare of struggling clouds in the cyclone, when the might of Him who makes the clouds His chariot, and walketh upon the wings of the wind, is most manifestly displayed in connection with the utter helplessness of man, and answer this question? Can any one gaze rapturously upon a rising or setting sun, lighting up the surrounding clouds with glorious effulgence, or painting them with tints most gorgeous, and then understand the "spreadings of the clouds"? What would you not give to witness again the following sight:—"Did you notice the wonderful atmospheric effects that were visible at Madras last Thursday? (July 18, 1872.) I think I never saw anything more beautiful, or anything more lifelike. For an hour or two the city, situated upon a flat plain, was surrounded by mountains as lofty and scenery as grand as any that Scotland, or even Switzerland, could boast of. The city was surrounded by a bank of clouds that formed a magnificent girdle of mountains—some black and frowning, others snow-clad, whose

> Rocky summits, split and rent,
> Formed turret, dome, and battlement
> Or seemed fantastically set
> With cupola or minaret;
> With crest as pagod ever decked,
> Or mosque of eastern architect.

Going towards this magnificent pile of cloud-mountains was like entering a pass; and, further on, the snow-clad peaks made me believe myself back in times long gone by, when, with alpenstock in hand, I crossed the Bernese Oberland, and looked up with eyes dimmed with delight at the glorious Jungfrau."

FIRE-WORSHIP.*

NOTWITHSTANDING long persecutions, which have continued over one thousand years, and only now are beginning to relax, and permit the Fire-Worshippers of Persia to worship there unmolested, a small, steadfast band has always remained in that land, preserving the faith of their fathers and their rites and ceremonials unchanged.

In Persia they are called Guebres. This is simply a corruption of the Arabic term Kaffir, which means an heretic, an unbeliever. In time it has become a word of contumely and scorn.

Although so few in numbers, yet the Guebres are a most interesting community, for in them we see the old Persian stock of the days of Cyrus and Xerxes unmixed with any other race; while the religion they practise is that which was introduced into Persia, or perfected by the famous Zoroaster, or Zerduscht, who lived at least twenty-five centuries ago.

Zoroaster was born in the northern province, called both then and now Azerbaijân; this name means the region of fire, and it may have been so called because the religion whose distinctive doctrine is supposed to be the worship of fire had its origin there. It is only just to state that intelligent Guebres repudiate this doctrine. They assert that it is a mistake to call them Fire-Worshippers. They say that fire is to them not an object of worship, but only a symbol of the beneficent Oromasd, or good God, who is clear and radiant and pure, like the glow of the rising sun or the flames of fire, and that it is through the symbol that they adore the good Spirit.

This may be true of the more intelligent followers of the doctrines of Zoroaster; but there is no doubt that the ignorant classes believe that light and fire are real emanations of God, and worship them as such. Fire is by them held so sacred that they never smoke tobacco, and for that reason it is not by them considered courteous to use the weed in the presence of a host or guest who is a Guebre.

In every household of the Guebres fire kindled from the sacred flame at the new year is kept burning the entire year. That is the purpose they follow; but whether they always succeed in preventing the fire from being extinguished is doubtful.

The Guebres have many peculiar doctrines and customs. One of these is the use of yellow in their garb; another concerns the theory of immortality. They maintain that there are two principles, the good and the evil, which they call Oromusdao and Ahrimasdao. The ancient Greeks corrupted these names to Ormusd and Ahriman. These two principles, or influences, fight for the mastery through the ages, seeking to win possession of the soul of man.

The new year is called by the Guebres the No Rooz, or New Day. It comes at the time when the sun crosses the line in March. Their traditions state that this festival was ordained by their great legendary King Shah Iemsheed. Although most of the Persians are now Mohammedans, yet they all accept the period for the commencement of the new year established in their country long ages before the camel-driver of the desert sent his armies to force them to his creed; and thus, at the No Rooz, Guebres and Mussulmen alike rejoice. The latter pretend that they celebrate the occasion because it is the birth anniversary of their Prophet, but this is a mere flimsy excuse, concocted in order to show their disdain for the Guebres. But in a hundred ways the Persians show that in their celebration of this annual festival they are following the traditions of their fire-worshipping ancestors.

Nowhere is the new year celebrated with more mysticism and pomp and universal rejoicing than in Persia. For weeks before it arrives the people begin their preparations for the occasion. Every one seeks to raise money to purchase the new suit of clothes he is expected to wear at the time, and the confectionery and provisions for the ten days of feasting, as during that period the shops are mostly closed. So important is it to be properly prepared for the No Rooz, that articles of price that are family heirlooms are often sacrificed in order to provide the needed money.

When the new moon of that month appears devout Persians look to the east, then, covering the face with their hands, they are slowly turned until, on withdrawing the hands, the gleaming sickle of the new moon is seen directly in front. Perhaps our superstition about discovering the

* From an article by Mr. S. G. W. Benjamin in the *Youth's Companion*.

new moon over the right shoulder is suggested by this Persian custom.*

The eve before No Rooz is also the occasion for a curious ceremony, evidently suggested by the mystical meaning the Guebres attach to fire and light. The common people leap over heaps of burning brushwood laid in rows. It is possible the heathenish custom alluded to in Scripture of "passing children through the fire" may be a form of this ceremony.

As the hour approaches for the sun to cross the line, the Shah assembles in the great audience-chamber of the palace with the high spiritual and temporal dignitaries of the kingdom. Money is distributed to all for good luck on the commencement of the New Year. At the moment the astrologers announce the No Rooz, the Shah gravely exclaims, "*Mambarêk bashêd!*"—"May it be propitious to you!" A sacred song of rejoicing is then sung by a mollâh, or priest; after this each courtier, according to his rank, offers his obeisance to the Shah, and receives a present from the royal hand.

THE BLANKET-FISH.†

"Do you see that short, thick-set man sitting on the boat?" asked a lounger at San Pedro; "well, he is an ex-pearl diver, ex-smuggler, ex-everything, and can tell some strange stories of this part of the world."

A little later I was introduced to the diver, who was a half-breed Mexican. He laughed when his experiences were referred to, and replied: "They were nothing. I have left the business, and have done with it for good or bad. It's a dog's life, this diving, and I wouldn't go back to it for anything you could offer. Why? Well, I am tired of it, and I was covered with a blanket-fish on my last trip down, and the second time means death." . . . "Am I sure?" And the half-breed smiled. "Well, I never knew it to fail. There were Ramoles, Narra, Nalona, all from my family, killed by the blanket-fish, and everyone had his warning. It is not necessary to believe it. I do, however. It is not a thing a man would be likely to forget.

"I have seen a good many of them in my time, but I was never cornered except once, and that was a year ago. I was one of the party that went to the pearl grounds in the *Centipede*, the boat that was never heard of after her next cruise. It came my turn to go down, and over I went; but as soon as I got down I felt that something was wrong—that something was going to happen—as soon as I struck the bottom. I landed among a fine lot of pearl shells, and had begun to fill my basket, when all at once I noticed a darkening about me, and looked up. I saw what appeared to be a blanket slowly settling down over me. I knew I had a chance; so I crowded down close to the bottom, hoping the fish wouldn't see me, and by luck it didn't. Just as it was ten or twelve feet off something alarmed it, and it drifted away. I was hauled up more dead than alive. I judged that the fish was at least thirty feet across, and if it had settled on me nothing could have saved me."

"This blanket-fish," said an American later on, "is nothing more nor less than a big Ray, and these yarns, though founded on fact, are a good deal overdrawn, though I am willing to confess that I have been as badly scared as the Mexican you speak of. It was in this way. Some time ago I was down the coast on a trip, and one evening I saw what I supposed to be a shark sailing about near the vessel. Wishing to have some sport, I put out the small boat, and, taking two or three men, pulled over to it. As it came by I put a harpoon into it. The next moment there arose from the water a Ray that must have been twenty-five feet across at least. It looked as big as a house, and as soon as it showed up my men screamed out, 'The blanket-fish!' They were Mexicans, and half scared to death. A moment later we were rushing over the water faster than I ever went before or since. The fish took us up the little bay, then turned and came down toward the schooner, going like a steam-engine. We piled up in the stern to keep her from sinking. Just as we got opposite the schooner the fish drove right under her, about amidship. Before we could make a move to cast off, we struck the schooner. To make a long story short, we found ourselves in the water alongside. The rope had broken, and the blanket-fish was gone. The force of the contact had smashed the cutwater of the boat in pieces.

"The divers have an idea that these fish settle down on you, as they have a very broad surface and a peculiar undulating motion in the water, using the side fins like wings. They are almost as powerful as a large whale, and one twenty-five feet across could undoubtedly move off with a large ship. In almost every locality where they are found stories are told of their carrying off vessels. Several instances of this have happened in the Gulf of Mexico, where devil-fish, as they are called there, have run off with smacks and small fishing vessels during the night. In one instance a skipper 'turned in' at night in a harbour, and awoke in the morning to find himself out of sight of land; a big devil-fish had run foul of the anchor and gone out of the channel so silently that none of the crew noticed it!"

Tampa Bay, Fla., is a famous place for these monsters of the deep, and often schools of a dozen or more are seen swimming about in circles. These Rays are among the largest fish known. Two immense fins extend out from each side, while from the tail projects a long lash-like whip, capable of doing severe execution. The writer was once poleing a boat over the Florida reefs in the vicinity of Key West, when a comrade, who had been sitting astride the cutwater dangling his feet in the water, threw himself back into the boat with a yell of pain, while a huge black Ray darting off over the white sand told the story. Both of his feet were cut almost to the bone. The weapon that produced the injury was a delicate, whiplike lash, smaller than a man's little finger.

On still nights in sub-tropical regions the Rays are often chased by sharks, and leap from the water in their attempts to escape, falling with a tremendous crash. The man-eating sharks with their thick skins are safe from their attacks, and often bite out great pieces from the side fins of the monsters.

At San Pedro and the various watering-places from San Diego north the Ray family makes itself disagreeably conspicuous. The smaller ones have a habit of hiding in the sand and presenting their spines for bathers' feet, while others are provided with electric batteries, which not rarely give the fishermen powerful shocks. I have known a man to be disabled for several days by harpooning one.

The Chinese monopolise the fishing in these waters, and are often victims of the practical jokes of the Mexican and American fishermen. An able-bodied torpedo will be brought ashore at San Pedro or Monterey, and the whites will wager a green Chinaman that he cannot lift it. The fish

* Something would depend on the way in which the turning was, from right to left or from left to right.

† From the San Francisco *Call*.

appears to weigh about six or eight pounds, and "John," after putting up his money, with a laugh at the simplicity of the "American devils," takes hold with both hands, and is stiffened out so quickly, that often he can do nothing but hold the fish and roar with anguish until he is released. The shock given by these fishes has been compared to that of a single Leyden jar, and can be plainly felt by fifty persons in a circle.

THE ONE-SCALE ATLAS.

MAP VIII.
by Richd A. Proctor

The linear scale radially is uniform throughout; the thwart scale is greater by 1/55th half way to the edge and by 1/14th at the edge.

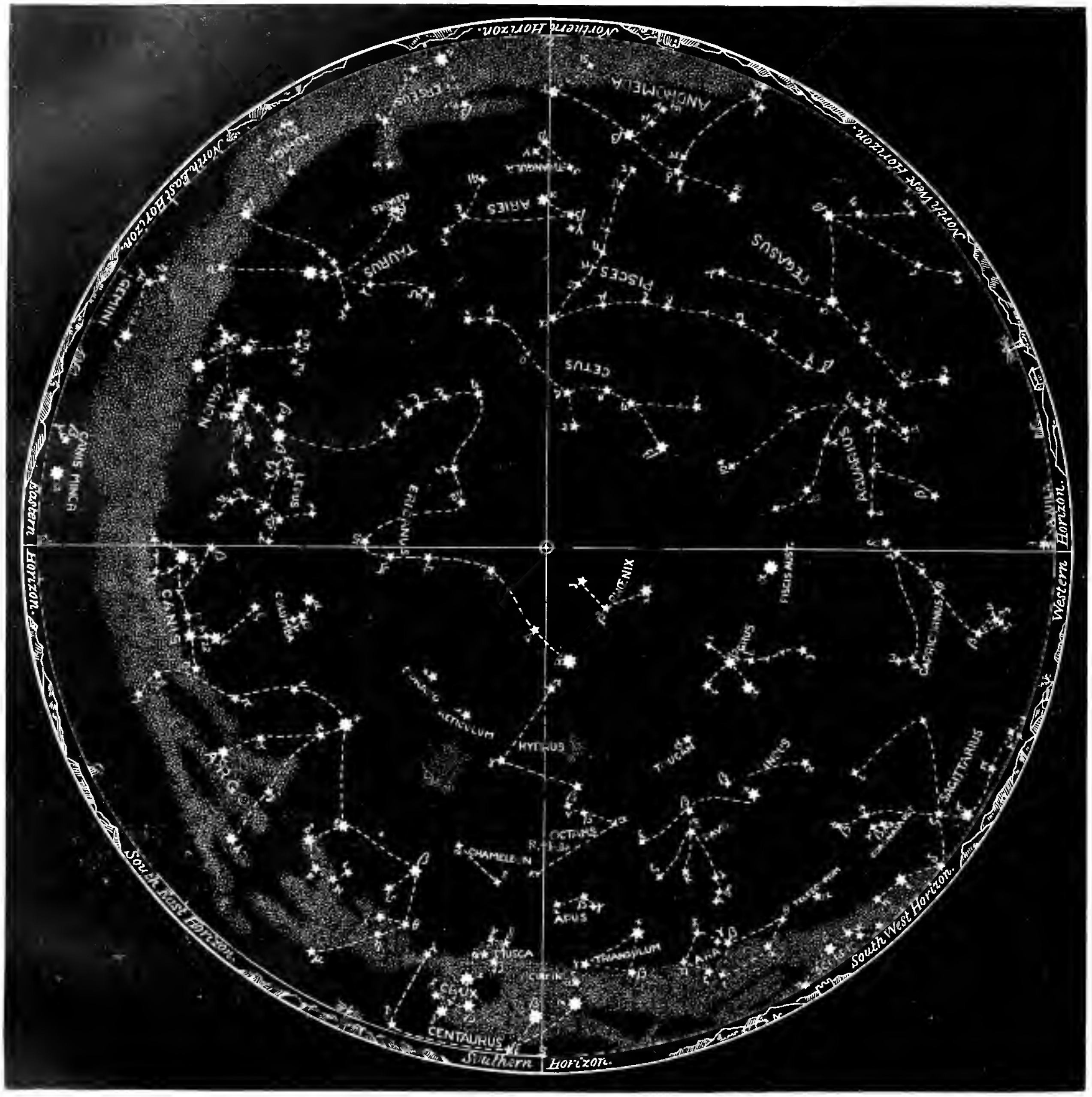
Scale of Miles at centre of Map, and radially all over Map.
English Miles
0 50 100 200 400 600 800 1000

Small areas are greater by 1/55th half way to the edge, and by 1/14th at the edge.

Edwd Weller del

THE SOUTHERN SKIES.

MAP XII.—FOR SEPTEMBER, OCTOBER, AND NOVEMBER.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 46° TO 24° S.)
AND THE
SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, Oct. 7.	At 11 o'clock, night, Nov. 7.	At 9 o'clock, night, Dec. 7.
,, 12.30 ,, ,, Oct. 15.	,, 10.30 ,, ,, Nov. 14	,, 8.30 ,, ,, Dec. 15.
,, Midnight, Oct. 22.	,, 10 ,, ,, Nov. 22	,, 8 ,, ,, Dec. 23.
,, 11.30 o'clock, night, Oct. 30.	,, 9.30 ,, ,, Nov. 30	,, 7.30 ,, ,, Dec. 30.

STAR MAGNITUDES.

First . . . . ✸ Second . . . . ✶ Third . . . . ★ Fourth . . . . ✦ Fifth . . . . ▲

THE MAN IN THE MOON.

By Stella Occidens.

"All that I have to say is to tell you that the lantern is the moon; I, the man in the moon; this thorn-bush, my thorn-bush; and this dog, my dog."—*Moonshine in "Midsummer Night's Dream."*

THE myth about the "Man in the Moon" is of great antiquity: how old we know not. Probably it dates back far beyond the time of Moses, for many ancient stories tell of the man who was punished by death for gathering sticks on the Sabbath (Numbers xv. 32–36); and though no allusion is made in the Bible record of this remarkable event to the moon, yet it was generally supposed long before the days of Moses that the unfortunate Sabbath-breaker was sent to the moon, and compelled to stay there for ever thereafter. The story as it stands in the book of Numbers is, of course, simply blasphemous, as it attributes the man's death to the actual command of the Almighty. A well-known German story tells about the man who cut sticks on the Sabbath, and was caught up in the moon, fagots and all, and there stands to this day. Another tale told in Swabia relates about a manikin who stole wood, and is still to be seen in the moon. A Dutch household myth accused the man in the moon of stealing cabbages on Christmas Eve: the neighbours caught him just as he was walking off with a good supply, and they "wished" him up in the moon. He stands there to this day, bearing his load of cabbages. It is said that he turns round once every Christmas Eve; but astronomy does not support the idea. In Sylt, the man in the moon was a sheep-stealer, and it was his custom to entice the sheep with a bundle of cabbages. He was placed in the moon, as an everlasting warning to others.*

In Schaumburg-Lippe, it is said that a man and woman were sent to the moon; the man because he prevented people from going to church on Sunday by strewing brambles and thorn-bushes in their way, and the woman because she made butter on a Sunday.†

Northern mythology tells about a giant who inhabits the moon, and is supposed to cause the ebb and flow of the tide. When he stoops, the water flows; and when he stands erect, the water subsides again.‡ This somewhat resembles the Scandinavian myth about Bil and Hjuki, who were taken up to heaven by Mâni. They were on their way to the well of Byrgir, bearing on their shoulders the bucket Soeg and the pole Simul. They were placed in the moon, and are supposed to regulate her waxing and waning.§ Evidently "Jack and Jill" of our nursery rhymes reproduce this legend. Grimm says that the water-pole of the heathen story has been transformed into the axis-shaft, and the pole into the thorn-bush.

In Hindu mythology the Moon—Chandra or Some—is a male deity, represented in one myth as the son of the patriarch Atri, and in another as arising from the milk-sea, when it was churned by the gods‖ so as to obtain the water of life. The moon is generally represented as wearing white garments, holding a mace in one hand, and riding in a chariot drawn by ten horses and antelopes. The hare is sacred to him, and the Hindus fancy that they see the outline of a hare on the face of the moon.¶

* Harley, "Moon-lore," p. 23.

† Baring-Gould, "Curious Myths of the Middle Ages," p. 192.

‡ Thorpe, "Northern Mythology," vol. iii. p. 57.

§ Baring-Gould, "Curious Myths of the Middle Ages," p. 200.

‖ Hence perhaps the theory that the moon is made of green cheese.—Ed.

¶ *Notes and Queries*, vol. vi. p. 232.

In Africa the man in the moon is supposed to have incurred the wrath of the sun, and is in punishment carved by the knife (that is by the rays) of the latter. This continues until the whole of the moon is cut away, and only a little piece left. The moon implores the sun to have pity on him, and leave this morsel for his children. The sun grants his request, and the moon grows from this little piece until at last it is a full moon. Then the sun begins carving again.*

In China the old man of the moon is known as Yue-lao, and holds the reins of marriages of mortals in his hands. The future husband and wife are tied together by an invisible silken cord, which is only severed at death. Harley remarks, in his funny way, that this must be the man of the honeymoon.†

A Slavonic legend says that the moon, king of night and husband of the sun, falls in love with the morning star, wherefore he was cloven through in punishment, as we see him in the sky. A Russian story is told about a man who sought for the isle in which there was no death. He took up his abode in the moon, but after a hundred years or so had elapsed Death came after him. A furious struggle ensued with the Moon, and the latter proving victorious, the man was caught up in the sky, and now shines "as a star near the moon."‡ It was not an unusual belief that the moon was inhabited: some thought her the place where human spirits either came or went. Others fancied it was a prison cage, in which, behind bars of light, miserable sinners were to be exposed to all eternity as a warning to others.§

Some say the man in the moon is Isaac, bearing a burden of wood for the sacrifice of himself on Mount Moriah. Others that he is Cain, carrying a bundle of thorns on his shoulders in punishment for offering to God the cheapest gift from his field.‖ Dante refers to this in the "Inferno," canto xx., line 123, where he speaks of "Cain with fork of thorns," and again in canto ii. of the "Paradise" he mentions "the gloomy spots upon this body" (the moon's) "which below on earth give rise to talk of Cain." The Jews have a story that Jacob's face is visible in the moon. According to a French superstition, it is Judas Iscariot, who was transported there for his treason. Grimm tells us that a religious superstition is handed down by Berthold, 145, that the moon is Mary Magdalene, and the spots are her tears of repentance.

In Greenland the sun and moon were said to be brother and sister. Malina was teased by her brother Anninga, and she ran away from him. He followed her, but she flew up in the air and became the sun, and her brother, who could not fly so high, became the moon. He is still pursuing his sister, hoping some day to surprise and capture her. "When he is tired and hungry in his last quarter, he leaves his house, on a sledge harnessed to four dogs, and hunts for several days. On his return he eats so much, that he grows into a full moon."

The Australians believe the moon to be a mischievous being, who went about the world doing evil. One day he swallowed the eagle god. The wives of the eagle came up, and the moon asked them where he could find a well. They showed him one, and as he stooped over to drink, they hit him on the head (an idea manifestly plagiarised by Miss Braddon in "Lady Audley's Secret") with a tomahawk, and out flew the eagle.¶

* Harley, "Moon-lore," p. 33.

† *Ibid.* p. 33.

‡ Ralston, "Russian Folk-lore," p. 183.

§ Harley, "Moon-lore," p. 18.

‖ Grimm, "Teutonic Mythology," vol. ii. p. 719.

¶ Andrew Lang, "Custom and Myth," p. 54.

The moon was not always supposed to be inhabited by a man. Thus a Chinese tale represents the moon Jutho as a beautiful lady, with a double sphere behind her head, and a rabbit at her feet.

> On a gold throne, whose radiating brightness
> Dazzles the eye—enhaloing the scene,
> Sits a fair form, arrayed in snowy whiteness.
> She is Chang-o, the beauteous Fairy Queen.
> Rainbow-winged angels softly hover o'er her,
> Forming a canopy above the throne;
> A host of fairy beings stand before her,
> Each robed in light, and girt with meteor zone.*

In Mangaia, the southernmost island of the Hervey cluster, the woman in the moon is Ina, the pattern wife, who eternally weaves beautiful cloth, *i.e.*, white clouds. Among the South Slavonians the moon is represented in a Servian song as a beautiful maiden, with "arms of silver up to the elbows," sitting on a silver throne which floats on water. A suitor comes to woo her. She avoids him, and sheds tears of anger, wailing with sorrow.† Every reader will remember the Hiawatha legend told by Nokomis:—

> Once a warrior, very angry,
> Seized his grandmother, and threw her
> Up into the sky at midnight,
> Right against the moon he threw her:
> 'Tis her body that you see there.

In the story of Iosco, the moon is represented as an aged woman with a white face and pleasing air, who advanced from behind a hill to greet them. She talks of the sun as her brother.‡

In Polynesia a story tells how the moon came down and picked up a woman and her child during a time of famine. She was working in the evening twilight, beating out some bark with which to make native cloth. The moon was just rising, and reminded her of a great bread fruit. Looking up to it, she said, "Why cannot you come down and let my child have a bit of you?" The moon, indignant at the idea of being eaten, came down forthwith and took her up, child, board, mallet, and all. The people in Samoa still speak of the woman in the moon. "Yonder is Sina," they say, "and her child, and her mallet and board." The same belief exists in the Friendly Islands and the Tonga group.§

A quaint story, told by the Indians in British Columbia to Mr. W. Duncan, relates how a child awaking in the night and feeling thirsty asked its mother for a drink. The mother not heeding, the moon came down and brought the child water from heaven. The child drank some, and was then enticed by the moon to return to her home above. After passing underground till they were clear of the village, they ascended to heaven. There they are to be seen to this day, and the child still holds the little round basket which it had in its hand when it went to sleep.‖

A New Zealand myth tells how in old days, before the moon gave light, a New Zealander named Rona went out in the night to fetch some water from the well; but he fell over something which happened to be in his way, and sprained his ankle. He cried aloud in his pain, and to his great horror he saw the moon approaching him. He caught hold of a tree and clung to it; but it gave way, and fell with Rona upon the moon. Another version says that Rona was falling into a well; he laid hold of a tree, which gave way, and which was afterwards removed to the moon with Rona, where he is visible to this day.

* Harley, "Moon-lore," p. 63.
† Ralston, "Russian Folk-lore," p. 183.
‡ Schoolcraft, "Hiawatha Legends," p. 289.
§ Harley, "Moon-lore," p. 57.
‖ *Ibid.* p. 36.

The Selish race of North-west American Indians have a tradition which Captain Wilson relates as follows:—"The expression of 'a toad in the moon,' equivalent to our 'man in the moon,' is explained by a very pretty story, relating how the little wolf, being desperately in love with the toad, went a-wooing one night, and prayed that the moon might shine brightly on his adventure; his prayer was granted, and by the clear light of a full moon he was pursuing the toad, and had nearly caught her, when, as a last chance of escape, she made a desperate spring on to the face of the moon, where she remains to this day." The Cowichan tribes think that the moon has a frog in it.*

A Buddhist legend relates how Sâkyamunni was at one time a hare. Indra, disguising himself as a hungry beggar, asked for food. The hare offered himself, and as a reward Indra took him up to heaven and placed him in the moon. A Sanskrit legend describes the moon as a watcher of the sky, who sleeps with her eyes open like the hare. The mythical hare is undoubtedly the moon. In the first story of the third book of the Pantschatantra, the hares dwell upon the shore of the moon's lake, and the king has for his palace the moon itself.†

Among the Hindoos and Egyptians the mouse was sacred to the moon. De Gubernatis says:—"The Pagan sun-god crushes under his foot the Mouse of Night. When the cat's away the mice will play. The shadows of night dance when the moon is absent." ‡

AMERICANISMS.

GERRYMANDER. This word has been already discussed in KNOWLEDGE. The term has been used in America since 1811, when during the governorship of Mr. Gerry the State of Massachusetts was so artificially divided up into electoral districts, that the Federal votes were massed together and in large part wasted; while by bringing into effective action Democratic votes which before had been lost in minorities, the Democratic party were enabled to carry everything before them. It appeared on counting the votes returned that two-thirds of the State voted Federal, yet through the artificial distribution of districts, the Democrats secured an overwhelming majority in the Legislature. Essex County, strongly Federal, was so peculiarly divided, that the map presented a ridiculous appearance. Gilbert Stuart, a painter of some distinction, remarked to Mr. Russell, the editor of the *Boston Centinel* (*sic*), that the map looked like some monstrous animal. Carrying out the idea he added a few touches, representing a head, wings, claws, and tail, and being apparently less familiar with natural history than with art, he suggested laughingly that the creature thus adorned "would do for a Salamander." Russell looking at the figure exclaimed, "Salamander! call it a *Gerrymander!*" and ever thereafter, in America, the name of Governor Gerry was associated with that kind of iniquity, though he was probably innocent of all part in the process of dividing up the State, "gerrymandering," of Massachusetts.

GET. A variety of uses of this word, familiar in England so far back as the memory of man goeth, are included by Bartlett among Americanisms—as "get out," used to express incredulity; to "get one's back up"; to "get round"; "to get the wrong pig by the tail"; and "got you there!" But

TO GET RELIGION is probably purely American. A man

* Harley, "Moon-lore," p. 69.
† Baring-Gould, "Curious Myths of the Middle Ages," pp. 202, 206.
‡ Andrew Lang, "Custom and Myth," p. 117.

in America "gets religion" when he has lost character. After thoroughly losing all semblance of decency, he can start a new character as a penitent, which usually lasts him long enough to get all he wants. The infamous Colonel Chartres used to say that he would give ten thousand pounds for a good character, because it would be worth twenty thousand pounds to him. He lived too early. Had he belonged to these days, and lived out West (for in the East and South this ghastly hypocrisy is almost unknown), he could have done all the renewed swindling he wanted by simply pretending to have "got religion." There is all the difference in the world, be it noted, between a man getting religion and religion getting a man.

TO GET THE MITTEN is used in America where in England men speak of "getting the sack."

G'HAL. Having the Bowery *B'hoy* American slang was bound to have also the Bowery *G'hal*. Where the fun of these extra aspirations comes in the dull Englishman fails to see. The B'hoys and G'hals in question are simply Boys and Gals with aspirations—strongly developed aspirations—for beer and skittles, candy and chewing gum.

GIMPY. Sprightly. Bartlett remarks that Forby notices the adjective "gimp" for neat, spruce, &c., as provincial in England. Considering that it is found in the classic lines of Burns, "gimp" may be regarded as not wholly unknown on this side of the Atlantic. But "gimpy," though a natural derivative, I have not heard in Great Britain or Ireland.

GIN MILL. A drinking place; much, as we shall see presently, that a preaching place is a gospel shop. In England we have "gin palaces."

GISM. Spirit. Akin probably to the Dutch "geest." It is strange that men found in old times in the breathing or *spiritus*, the breath or *anima* or *pneuma* or *psyche*, the suggestion of soul or spirit. And yet perhaps it was not very strange: for the breath seemed to them the "invisible part of man." The classic languages could find but one word for the Holy Ghost, for the spirit of a man, and for his breath. I suppose the mystery of the invisible, yet manifestly existent breath of a man, led men to regard it as the true spirit or soul, seeing that with its departure life departed also, the soul seeming to pass away to heaven. What would have been thought of any one who had explained in those times the real nature of the breath drawn in and the chemical changes which have taken place ere the breath is breathed out? It would have seemed like a wicked attempt to destroy men's faith in the immortality of the soul. Yet it is strange to think that "in=breathing" should have been accepted as equivalent to "inspiration" in the religious sense, or that men should have found the suggestion of something holy in an *afflatus*, or full breathing. We should find nothing specially suggestive nowadays in "The Holy Wind" (though that is almost the exact equivalent of the Greek for "The Holy Ghost," *Hagion Pneuma*) or in "The Sacred Breath," though that corresponds exactly with the Latin for the same (*Spiritus Sanctus*). We might as reasonably speak of "Holy Oxygen," or "Divine Carbon Dioxide," or "Sacred Sulphuretted Hydrogen." An American means no more when he speaks of "knocking the *gism*" (or gas) "out of any one" than an English boy means when he talks of "knocking the wind out of a fellow."

GIT. This word, which is a veritable Americanism, Bartlett, of course, utterly fails to understand. He says it is equivalent to "go it," of which it may be a contraction. This is sheer nonsense. It is simply "get" mispronounced, just as it always is mispronounced by the vulgar in "forget"; and the only strange thing about the Americanism "git" is its quaint use alone for "get out." The average cockney says "git" as uniformly as the average American cowboy in such expressions as "git up" (generally addressed by the suave coster to his patient Neddy), "git along," and so on. But it is only in America, so far as I know, that any one will say simply "git," as a gentle hint that a man's room is more desired than his company. The hint may be given either with the simple monosyllable "git" or in the form "you git." It is equally an Americanism when the nigger pronunciation "git" is changed to the more civilised "get"; for only in America would "get" or "you get" be regarded as equivalent to "get you gone" or "you get out." They tell in the West, with some natural pride, of a laconic conversation between a miner and a thief (sometimes a farmer takes the miner's place, and a horse thief replaces the thief unadorned—but, anyhow, one man was presumably honest, and the other more or less "on the cross"). The ostensibly honest man sees the thief trying to make his way in to rob, and, holding a revolver at his head, remarks, "You *get*," receiving for reply, as the thief recognises the position, the anti-rhythmic response, "You *bet*."

GIT UP AND GIT. This is a development of the simple "git," somewhat as our English "he's gone and done it" is a development of "he has done it," and as the nigger "he's done gone done it" is a development of that. These redundancies and reduplications characterise the speech of the uncultured, even as among the early Greeks "tetupha" and "tetummai" established themselves as the expressions of very definitely past actions. We might interpret "git up and git" to mean simply "arise and go," were it not applied constantly to cases where no arising is called for or possible.

In the South the expression "git up and dust" is often heard. Here "dust" is short for "make the dust fly," and suggests an even more rapid exit than the simple "git."

TO GIT TO do anything is a niggerism for "getting leave." Bartlett, oddly enough, goes through numbers of examples of the use of "git" which are obviously simple mispronunciations of "get," yet sees no occasion to correct his preposterous explanation of "git" as a contraction for "go it." One might as reasonably imagine that our cockney "forgit" is contracted from "forego it."

GIVEN NAME. As sometimes in Scotland, the expression "Christian name" is commonly replaced in America by "given name." The expression is Puritan in origin; and may probably be traced back to the time when the Christian name was always a saint's name, and superstition had associated each such name with the special influence of the patron saint. Among the Puritans in times before America was colonised, a feeling of dislike, amounting to hatred, had sprung up against such superstitions, as the names in common use among the early Puritans attest. They were "given names." Some of them must have been unpleasant gifts.

TO GIVE OUT, to become exhausted. "Yet did not that widow's cruse *give out*," a Western preacher would say, meaning that the cruse did not fail.

GIVY. Yielding; ready to "give," in the sense of bending easily.

GLADES. The word "glade" of course is English, signifying, when properly used, a bright open place in a forest, where all around is more or less in shadow. In the Southern States this term has come to be applied—quite wrongly at first, though now custom justifies the usage—to grassy tracts covered with water, glades proper being distinguished as "dry glades." The word is akin to "glad," "glow," &c. The wet glades are far from being gladsome places.

G'LANG. If clipping good English makes an Americanism, *G'lang* may be regarded as American for "Go along." Haliburton has somehow associated the contraction with the emphatically Transatlantic address of Sam Slick to his horse, "G'lang, ye skunk, and turn yer toes out pritty."

GO. Making a go of anything, is succeeding in it. Probably the usage is derived from the old-fashioned way of starting a race with the word "go," pronounced so soon as the starter sees that the contestants are on equal terms. A false start is no *go*. In England, oddly enough, we have the negative form of this usage, while we seldom hear the positive form, except provincially. An Englishman will say, "It's no go," who would scarcely think of saying "It's a go."

"GO GOOD," for taste good may be regarded as not less English than American.

"GO A CRUISE," used for "take a walk or ride," is nautical English, and probably as much used in English maritime counties as in New England, where, indeed, it is almost limited to seaside places.

GO AHEAD. Although in its verbal sense this is a good old English expression, it is claimed as specially characteristic of Americans to *go ahead*, and used adjectively *go ahead* may be regarded as distinctively American. It is perhaps characteristic of the three great divisions of English-speaking races that our favourite expression in the old country is "All right," while the favourite American expression is "Go ahead," and in Australasia men say "No fear." This triple set of sayings is better than the French aspiration (rather more than satisfied now perhaps) for *la gloire*, or the general submission of Continental nations to military discipline. We English-speaking races find fault with each other, forgetting our kinship; we laud this, that, and the other distinction, often mere tinselling, of other races; but where now, or in the past of the world, has any race, regarded collectively, made a deeper mark in the history of the world? What other race, or set of races, has ever so definitely acted on the triple principle, or has so thoroughly justified it — See that all is right, then go ahead, and fear not. Despite the savagery shown too often by British Buncombe, by American spread-eagleism, and by Australian assertion of "Australia for the Australians," the English-speaking races have always shown (on the whole) the sense of duty expressed in our British "All right," the aspiration for progress expressed in the American "Go ahead," and the confident but unboasting courage expressed by the Australasian "No fear."

TO GO BACK ON. This peculiar expression for turning against, or forsaking any one, must surely be an Americanism. I have never heard it in any part of Great Britain, nor have I ever met with any one who had. Even in America the expression is not general. It is Western, or rather, had its origin in the West. Every English reader remembers the humorously pictured perplexity of the clergyman from the East, when told that the defunct miner "Never went back on his mother." I imagine, but without a particle of authority for the supposition, that the expression was first used by teamsters, and was suggested by the going back of a waggon on a steep slope unless blocked. Such experiences must have been common in the old waggoning times out West, in the mining region of the Rocky Mountains. Virgil evidently had some such idea in his well-known description of the oarsman pulling against stream. He says he has seen things *go back on* the labourer—

> . . . *retro sublapsa referri;*
> Non aliter quam qui adverso vix flumine lembum
> Remigiis subigit, si brachia forte remisit,
> Atque illum in præceps prono rapit alveus amni.

PHOTOGRAPHS of the sun were taken at Greenwich Observatory on 199 days during 1886, while photographs from India filled in the gaps for 164 days, so that the record of observations is complete for all but two days. The area of sun-spots and faculæ has continued to decline during 1886 and 1887. There were sixty-one days in 1886, and from October to April 17 last, seventy-three days on which no spots appeared.

STRANGE CHANCES.

THE question of the occurrence of unusual events, such as that considered in the article, "A Perfect Innings at Cricket," last month, when only a sufficient number of trials is allowed, leads to some of the commonest difficulties in regard to matters of chance. Indeed, one may say that the very elect are apt to be deceived in such matters—meaning here by the very elect, mathematicians themselves.

It is noteworthy, indeed, that problems in chance are very apt to deceive mathematicians whose researches have lain in other directions. A well-known example of this is the case of d'Alembert, when the very simple problem was propounded to him, What is the chance of tossing heads once at least in two trials? He replied, and not hastily, but after careful study of the matter, "Two in three, or the odds are two to one in favour of success." In reality, the chance is three in four, or the odds are three to one in favour of tossing one head at least. Yet d'Alembert's reasoning seems at first sound, and was long held by him to be unanswerable:—There are three possible events, viz., both tossings may give head, or both may give tail, or one may be of one sort, the other of the other; of these three events only one is unfavourable; since, then, two out of three events are favourable and one not, the chances of success are two out of three, and the odds in favour of success are two to one. The error lies in omitting to notice that one of the three events is twice as likely as either of the other two; for while we can only get two heads in one way, and two tails in one way, we can get a head and a tail in two ways; viz., first tossing head, second tail, or first tossing tail, second head. There are, in fact, four possible events, viz., head, head; head, tail; tail, head; and tail, tail: and *these four are equally likely*. Wherefore, since only one is unfavourable, the chances are three in four for success, or the odds against failure are three to one.

The words italicised are those which in every such discussion of a chance problem must always be represented; that is, the question of the probability of the different kinds of result must always be considered as well as their mere number.

But this problem of d'Alembert's might be treated like our cricket problem; and for my own part I prefer always that more general way of treating such problems. Thus the real question is, What is the chance that "tail" will be tossed at both trials? Now the chance at each trial is clearly one-half, hence the chance that both trials will give a "tail" is a half multiplied by a half, or one quarter; that is, one in four, or the odds are three to one against this happening.

If we dealt in this way with the probability of tossing head once at least in twenty trials, we should find it to be 1,048,575 out of 1,048,576, or the odds against tossing always tails (or always heads) in twenty trials are 1,048,575 to 1.

But it is in watching, or thinking about, a great number of trials, that errors are most commonly made. The laws of probability assure us that if a thousand millions of trials were made, there would be nearly a thousand cases in which "heads" would be tossed twenty times in succession—each trial being independent, so that as soon as a "tail" appeared the trial would be concluded, and a fresh one have to be begun. And further, the laws of probability assure us that, although on the average there would be only one such marvellous run of heads in 1,048,576 trials, yet the chance of tossing twenty heads in 1,048,576 trials would be more than one-half, or the odds would be in favour of such an event. (About three-quarters of a million of trials would give an even chance.) But if an experiment is commenced, and after long and wearisome series of trials—say, few thousand—no such series should appear, as is exceedingly likely, then the experimenter would argue that, since by the laws of probability the unsuccessful trials already made can have no effect on the results of future trials, we are no nearer success than at the beginning. Another series of 10,000 trials might be carried out with similar want of success, and another, and yet another—a hundred such trials taking us to a million: if all these were similarly unsuccessful, and there is no reason why they should not be, we should be as far from success as at the beginning. Going on in that way would be useless—it would seem—or, in other words, the laws of probability have in this case misled us.

The fallacy of all this lies in the assumption that that which is likely is sure to come off. If we fail in 10,000 trials we may equally fail in the next, and the next, and so on. But inasmuch as we have about one chance in 100 of succeeding in 10,000 trials, whereas at each trial we have but about one chance in a million, we must not treat a chance of the former sort as if it were no greater than a chance of the latter. And to bring the matter down to the test of manageable experiment—it is almost certain that in 10,000 trials there will occur one case at least of thirteen successive "heads"—this has been tried, apart from the numerical considerations which show it to be certain.

Imagine, then, 80 trials of this kind, giving almost certainly about 80 runs of 13 heads (for if some gave none, these failures would be made up for by others which gave two or more such runs). Here, then, are 80 cases of 13 heads in succession to which we may limit our attention, for no shorter runs can have any bearing on our attempt to get 20 successive heads. We may regard the continuance of these 80 trials—to see how many more heads there may be—as if they were fresh trials. Now it would not be thought a very wonderful thing if in 80 trials we obtained a run of seven heads, which with the thirteen already given would be the 20 heads required. Hence this reasoning based on actual experiment shows that in 800,000 trials there is a good chance of tossing 20 heads in succession, wonderful though such a series may be, and incredible though it might seem during actual experiment on so wearisome a scale that any good could result from going on with the tossings.

It must be remembered in all such cases that success may come off at the first trial, and is quite as likely to come off at that trial as at any other. It is this circumstance which causes the answer to the famous Petersburg problem to be so seemingly monstrous:—How much should be paid, asks that problem, for the privilege of tossing a coin and receiving 2*l*., 4*l*., 8*l*., 16*l*., or so on, always doubling, according as you fail to toss head at the first, second, third, fourth, &c., trial. The true answer is that no sum, however large, will fairly represent the price you should pay. You have but one trial, just as in a lottery you may have but one ticket; but the number of prizes is infinite, and you *may* draw one of the biggest in your one trial. According to the laws of fair lotteries, you must pay for your chance of getting each ticket. Thus you must pay 2*l*. for the chance—equal to certainty—of getting the smallest prize at least; you must pay half of 4*l*., or 2*l*., for your chance (one-half) of getting the 1*l*. prize; you must pay one-quarter of 8*l*., or, again, 2*l*., for your chance (one-quarter) of getting the 8*l*. prize; and so on, always the same sum of 2*l*., for your chance of getting the 16*l*. prize, the 32*l*. prize, the 64*l*., 128*l*., and so on for ever. Hence you ought to pay, if you should have such wealth, an infinite number of sums of 2*l*. This sounds like nonsense, because if you have unlimited wealth it would be far better to keep it. Yet the answer is right, regarded merely in its numerical aspect; for the sums you have the chance of winning are enormously greater, one may say infinitely greater, than the sum you are risking, let it be what it may.

The lesson really taught by the Petersburg problem is the folly of the gambler's notion that his chance of winning a stake represents its actual value to him. We see at once that a man must be an idiot who would pay, say, 10,000*l*. for a chance in such a lottery as is described above, though the actual value of his chance is very much greater. But a man of the gambling type does not hesitate for a moment to regard a ticket out of 200,000, where the prize is 200,000*l*., as worth not only 1*l*., its mathematical value, but much more—he will gladly pay three or four pounds for such a ticket, which, regarded as property, is worth much less even than the 1*l*. which represents its due proportion of the great prize.

The readiness, too, with which many will buy tickets in a lottery, and their unwillingness to buy a chance in any such venture as the Petersburg problem, shows how little men realise the meaning of large numbers. A gambler begins to see what he is doing when tossing is in progress, the first "tail" (let us suppose) to limit the amount of his prize. But when he hears of a scheme like the Louisiana Lottery, in which there are a hundred thousand tickets, he buys his ticket with the vaguest idea as to what such a number really represents. If it could be pictured to him in a suitable diagram, or if he could be shown a heap of grain in number equal to the number of tickets, and recognised one only among all these as representing his chance, he would probably think twice before investing his money on so precarious a venture. But as matters are, a certain air of mystery hangs over the event: something occult seems involved; in such sort that superstition comes in to suggest that by noting omens or dreams, or by venturing on some specially selected number, he will have a better chance of winning than that mere 100,000th, or one-thousandth, or whatever it may be, which the laws of probability assign to him.

There are other points in regard to which the ways of the gambling community are interesting, not to say amusing and unreasonable. The regular gambling fraternity, those who make a business of it, are apt to express contempt for the way in which the verdant gamblers whom they despoil aim always at getting a great prize for a small risk—as in buying a lottery ticket, backing the favourite, and so forth. They themselves, however, are quite as unwise in their systematic gambling, and would lose in the long run quite as much if they limited all their ventures to fair ones. One can lose a fortune, for example, quite as readily by always laying the odds as by always taking them, if the true odds are equally followed. It is only because laying the odds gives the bookmaker a better opportunity to bet on unfair terms that in the long run he always comes off best, while, in the long run, the backers of favourites are brought invariably to ruin. But the bookmaker falls into the mistake of supposing that in the system of laying odds against events more or less unlikely to happen—and generally even the favourite horse in a race is more likely to be beaten than to win, though more likely to win than any other individual horse in the race—there is safety, and not only safety, but the assurance of success and wealth in the long run.

It is for this reason, probably, that while we find the inexperienced pigeon seeking always some such way to wealth as the purchase of a lucky ticket in some great lottery, or backing horses at long odds and winning, the more practised gambler of the rook species is the victim of a delusion opposite in character, but as fatal in its effects, unless corrected by devices not depending on chance—faith in gambling systems, or what are sometimes called martingales.

These systems, some of which I have described elsewhere, are singularly illusory. To study their working, not only as given in detail by a believer, but as carried out again and again in practice, they seem practically perfect. In every case, the plan is guided by the gambler's actual loss and gain; when he has lost he wagers somewhat more at the next turn than before his loss; when he has gained he wagers somewhat less, the actual difference depending on the particular system employed. But always after continuing the system long enough, it results, unless there is an improbable run of bad luck, that the losses are all cleared off, and a certain sum, the same in every trial, is secured. It can be shown, not only vaguely as by the believer in the system, but by mathematical demonstration, that the chances are greatly against failure to secure this definite sum, in any given trial of the system. Theoretically, indeed, if the gambler's pocket is but long enough, and the limit put by the bank on stakes is high enough, the process is certain to end in the gambler pocketing his 10*l.* or 20*l.*, or whatever the amount he assigns at the outset for each trial, may be. So he may go on winning twenty, thirty, forty, perhaps a hundred times in succession, to the envy of all those who are not acquainted with the plan on which the system is worked. He may improve the system until he might get a thousand successes for one failure. Thus faith grows in such a system until the gambler assures himself that he has the secret of securing unlimited wealth. Yet, all the while, every step of his career is towards ruin.

The trouble lies here:

The surer the method of the system the smaller is the sum made at such small risk as remains on each trial. This circumstance is disguised by the fact that the risk arises not only in each trial regarded as a whole, but in the progress of each trial. For instance, the trial having begun and gone unfavourably for several steps—which is always likely enough—the risk that a fatal run of luck will occur before the losses are wiped off is now very much greater than it was at the beginning of that trial. Or if, after all has gone well at first, a run of bad luck comes, then, though the player is no worse off as to risk than at the outset, he has lost all the benefit of the run of favourable luck, and is situated as if starting on a fresh trial. The gambler blinds himself to this, though every stake his system calls on him to deposit should remind him of it; but in reality this is where the danger chiefly lies. For the rest, it is easy to see that the high probability there always is of winning at any given trial affords no assurance against loss. If a man A says to another, B, you shall draw again and again from this urn, in which—as you can see and count—there are one thousand balls all white except one, which is black, replacing the drawn ball after each trial, and every time you draw a white ball you shall pay me 1*l.*, while every time you draw the black one I will pay you 1,000*l.*, A would be most likely to have a long series of successes before he had to pay 1,000*l.* Yet in the long run A would not be likely to gain by such a venture, and he might lose very heavily. If he agreed to take only 18*s.* from B at each drawing of a white ball—which would correspond with the position of a gambler working out a system at a public gaming-table—he would be sure to come off second best, if he only continued long enough.

And that is actually the way with all such systems. They are pretty sure to work successfully many times before there comes the run of luck on which they fail; but that run is quite sure to come long before the gambler has made as much by the system as will repay him for his time, trouble, and worry; and each failure will, on the average, sweep off more than the previous successes have secured in the way of gain.

THE NATURALIST'S LABORATORY.

CONTRIBUTION VIII.

LABORATORY REQUISITES.

THERE are many things which add very materially to the comfort of the student, and convenience in the prosecution of his studies, that have never been discussed in any systematic treatises, but are nevertheless of the first importance, since they usually draw the line between slovenly and neat work in the laboratory.

Preserving and Macerating Pans.—It is well known that the dissecting-rooms of most of our universities and colleges are remarkable for their pestiferous atmosphere. Where human anatomy, or the structure of animals much over the size of a rabbit or cat is taught, this undesirable state of things can be minimised by careful previous treatment of the "bodies" and "parts" in question; but it cannot be wholly subdued without enormous expenditure and unnecessary labour. In ordinary biological laboratories and in private rooms however, anything of the kind above alluded to ought not to be tolerated, especially as nothing much larger than a cuttlefish or a cat need be dissected; and most of the large firms of potters, such as Doulton & Co., of Lambeth, and others, manufacture glazed earthenware pans, with suitable, closely-fitting covers, of various shapes and sizes, for manifold uses in the household and kitchen—*e.g.*, ham pans, rinsing red pans, &c. The animal under operation should be wrapped in a calico cloth well wetted with strong methylated spirit, and then immersed or partially submerged in diluted spirit in the pan, during the intervals between work. Where no suitable cover is provided with the pan a piece of window glass cut approximately to its shape may be used, and total exclusion of air, for even a protracted period of time may further be secured by a liberal use of hog's lard, after the fashion of a cement. Twenty such vats in a private room cannot, under such circumstances, pollute its atmosphere, or prove otherwise offensive. Similar vats without covers are decidedly preferable to wooden tubs for macerating work, which, it need scarcely be remarked, ought always to be conducted out of doors, or rather, in a special outhouse or shed.

The Dissecting Dish, as its name implies, is useful for animals of small size only, such as earthworms, snails, frogs, &c. Although an ordinary pie-dish can, and has, largely been used for this purpose, it is unquestionably a very imperfect article. Let us take, for example, a frog: to learn its anatomy thoroughly, several days of work should be spent upon its dissection. The dish should be filled to the depth of about an inch and a half with a suitable mixture of paraffin wax and hog's lard melted together at a low temperature, and poured, whilst still fluid, but on the verge of becoming solid, into the dish; this will prevent any marked after-shrinkage. The animal should next be fastened upon the paraffin when solid, with pins, and covered, or partially covered with dilute spirit. After a day or two, when some critical portion is about to be examined, the student often finds, to his chagrin, that the liquid around his dissection has insinuated itself between the sides of the dish and the edges of the paraffin bed, by an almost imperceptible shrinkage of the latter, sufficient, however, to render it so unsteady as to preclude the possibility of work, except with the utmost difficulty. To obviate any such mishaps the author has devised a dish, shown in section at fig. 1. It may be oval or oblong (preferably the latter) in shape; its

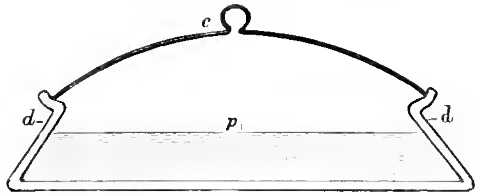


FIG. 1—DISSECTING DISH.
c. Cover; *d.* body of dish; *p.* bed of paraffin. (*Sectional Diagram.*)

sides slope upwards and inwards, and thus effectually prevent the bed of paraffin from shifting or floating during the dissection. The upper rim of the dish should be indented, so as to admit of a cover which will not easily slip off. Both dish and cover may be made of earthenware, of indurated wood, or the new paper-bottle material invented by Mr. H. L. Thomas, of Chicago, and now being introduced into this country by Messrs. Tulk & Co., of Walbrook.

Museum Bottles.—One of the greatest difficulties experienced by museum curators has hitherto been in the display, to the fullest advantage, of preparations in spirit. However carefully these are put up, the time arrives, sooner or later, when it is found necessary to readjust the object or to renew the spirit, either on account of evaporative deterioration or discoloration of the fluid. The bottles are necessarily expensive, and those of large sizes usually have to be made specially to order—of such, those with

FIG. 2.—PATENT LOCK-STOPPER, suitable for Museum Bottles.

evenly ground tops, over which are fastened circular discs of glass, by means of a more or less spirit-proof, colourless cement, are mostly in vogue, and there certainly is an advantage in the clear transparent top, which admits light, and thus shows every part of the structure displayed to the best advantage; yet the drawbacks are considerable, *e.g.*, the cases in which they are placed may, and often do, overshadow the transparent tops, which are, moreover, liable at all times to become detached, or, on the contrary, are found inseparably fastened, when it is extremely desirable to gain access to the preparation. All these objections have been overcome by the invention of the "Patent Lock-Stopper," now being manufactured on an extensive scale by a Limited Company, whose headquarters are at 57 Moorgate Street, London, E.C. The stopper has never yet been applied to the purpose above mentioned, but is chiefly used for chemicals, pickles, preserves, condiments, &c. It consists of a metallic cap, upon the upper surface of which (see fig. 2) there are two nearly semi-circumferential inclined ridges. A metallic bar, with downwardly projecting catches, which slide into the grooved neck of the bottle, is fastened to the centre of the upper surface of the stopper by a pin or axis, upon which it can rotate horizontally; so that when the stopper is made to slide side-wise upon the neck of the bottle, and the bar is turned round so as to pass up the ridges, on the edges of the upper surface, as shown in fig. 2, the stopper becomes very firmly attached to the bottle. The under surface is provided with a yielding pad of material which is spirit, acid, and oil-proof, and when properly adjusted makes a perfectly air-tight joint. To remove the stopper at any time, hold the bar as shown in the engraving, turn it down the incline, and *slide* the stopper off; to replace it, hold the bar, as in the figure, slip both ends into the groove round the neck of the bottle, slide the stopper into its place, and screw the bar up tightly. Specially-made bottles of any size can be provided with stoppers such as that described above, at a cost not much in excess of that charged for common corks.

The next contribution will conclude the subject of laboratory requisites, and pass on to a consideration of instruments and their uses.

VARYING ASPECTS OF THE EARTH'S GLOBE.

IT is often convenient in astronomical study to consider the apparent aspects of the latitude-parallels and meridians of a globe such as PeP'e' (fig. 1), rotating about an axis aOa', to which the polar axis, POP', is inclined. Suppose the rotation such as (at the commencement of rotation) to bring P *towards* the observer, from its position as shown on the edge of the globe—the observer's distance being supposed very great compared with the dimensions of the globe.

Let us first consider certain properties which will aid in the consideration of these effects, and then exhibit an illustration of the method of construction by which the meridians and parallels of the globe after any given rotation around aOa' may be laid down.

First, every point on the *globe* PeP'e' or within it describes in reality a circle around the axis aOa', in a plane at right angles to that axis. Seen, therefore, from a distant point of view so placed that the line of sight to O is at right angles to the *circle* P eP'e', any point on or within the globe (supposed for the moment to be transparent) will appear to travel backwards and forwards in a line parallel to *t* O t', moving from right to left in the nearer half of its course, and from left to right in the farther part.

Secondly, the rate at which such a point would appear to move in different parts of its line is very easily determined. Take, as an instance, the point P, and draw P o p at right angles to aa'. Then the line P o p is that along which the point P would appear to move backwards and forwards. But we know that in reality the point P is describing a circle, of which P o p is the projected view. Suppose this circle opened out by being rotated about the diameter Pp—into the circle PRpR'. Then, if the points 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 are equidistant points around the circumference of PRpR', it is quite clear that the uniform rotation around aOa' will bring the point P to the apparent position, q, r, o, s, u, p, u, s, o, r, q, P (obtained by drawing the lines 1—11, 2—10, 3—9, &c.), after successive equal intervals of time. We have precisely the same construction for any point whatever, either on or within the globe. The point n, for instance, moves to n′ and back to n, at a rate exactly proportional to that at which P moves to p and back to P.

Thirdly, every line through a*O*a′ describes a double cone about a*O*a′. The figure of this double cone for the line POP′ is shown; and it is clear that not only would it be as easy to show the cone for any other line through O, but also for a line through any other point in a*O*a′. For instance, the *line* c c′, which crosses a*O*a′ at a point near R′, describes a double cone, of which this point is the vertex, and of which the upper is the lesser portion. The line a a′ describes a simple cone of which a is the vertex. *Finite lines which would have to be produced to meet* a*O*a′ *produced*, describe only *frusta* of cones; but, mathematically speaking, we say that every line through any point of the line of which a*O*a′ is a part, describes a double cone around this line as axis.

Fourthly, bb′, aa′, cc′, tt′, &c., represent circles around the axis POP′, that is, they represent latitude-parallels. Let us examine into the apparent shape of the ellipses into which these circles are projected as the rotation we are considering goes on. Take first the equator, represented by e O e′. The points e and e′ are those farthest from the plane t O t′, and it is obvious that they will remain so throughout the rotation. Therefore if the lines e e, e′e′ are drawn parallel to t O t′, the ellipse representing the equator must always touch these two lines. Further, since it is easy to find the positions assumed by the points e and e′ (by following the plan already described for P) for a given amount of rotation, we immediately find the points at which the ellipse touches the lines e e and e′e′. It is also obvious that the greater axis of the ellipse cannot but be at right angles to the polar axis of the globe, and we have seen how the position of this axis is determined. Suppose, for instance, that the rotation around a*O*a′ has taken place through an angle equal to the angle P o 2, then the north pole has come to r, and the south pole to r′, therefore r O r′ is the position of the polar axis. If, then, in fig. 2 we draw POP′ in this position, the line EOE′ at right angles to POP′ is the major axis of the ellipse representing the equator. And as it is easy to draw an ellipse having this line for major axis, and touching the lines e e and e′e′, the outline of the equator is determined to be that shown in fig. 2. In this case E e′E′, fig. 2, is the nearer part of the ellipse, the lighter half of the ellipse lying on the farther half of the globe, supposed for the moment to be transparent: but if we had supposed the rotation to have been through an angle Po10 (not the acute angle, but the angle measured by the arc PRp10), we should have obtained the same shape and position for our ellipse, only the lighter part would have been on the nearer half, and Ee′E′ on the further half.

The case of a latitude-parallel is just as easily examined. Take the parallel c n c′, for instance. When P is at r, n, the centre of the parallel, is at *n*, and a line through *n* at right angles to r r′, equal in length to the *line* c c′, and bisected at *n*, is the major axis of the ellipse representing the latitude-parallel c c′. Further, c will be the point farthest from, and c′ the point nearest to the *plane* tOt′, throughout the rotation we are considering; and the ellipse will therefore always touch the lines c c, c′c′, figs. 1 and 2. If, therefore, in fig. 2 we

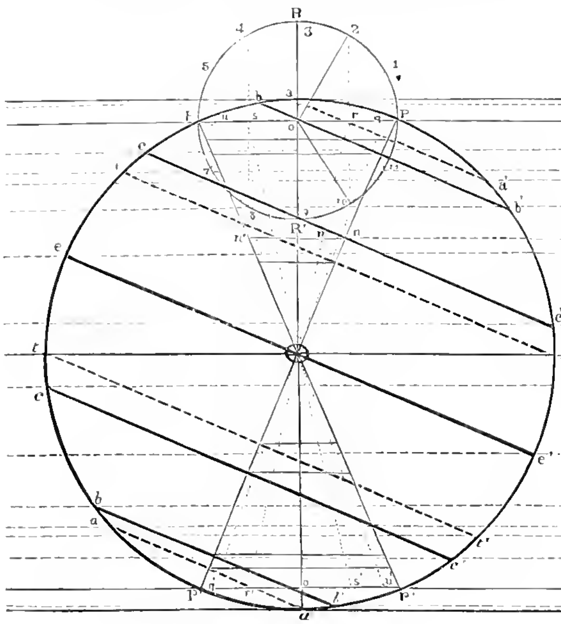


Fig. 1.

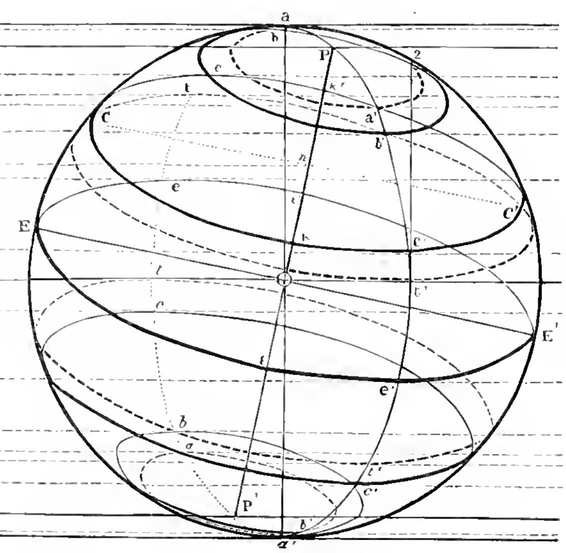


Fig. 2.

take *n*, determined by drawing *n* n *n* parallel to OO, to meet PP′, fig. 2, and take CC′ in fig. 2 equal to cc′ in fig. 1, at right angles to PP′ and bisected in n, an ellipse, Cc′C′, having CC′ as greater axis and touching the lines c c, c′c′, represents the latitude-parallel required.* The part Cc′C′ is the nearer, and it is clear that more than one-half of the parallel lies on the hemisphere turned towards the observer.

In this way every latitude-parallel is determined. The parallel a a′ presents a peculiarity worthy of notice. Since this parallel has upon it a point, a, which is the uppermost point of the globe, and since this point cannot but remain uppermost throughout the motion, the ellipse representing this parallel always appears to touch the outline of the globe's disc in the point a.

* It is easily seen that the points of contact of all the ellipses with their corresponding pairs of parallels lie on the ellipse a t′*a* t (fig. 2); since these points of contact, originally lying on the circle to a e′*a*′e, must be brought by the rotation of this circle around a*O*a′ lie on an ellipse having a*O*a′ as axis, and passing through the points P and P′. Also it is obvious that the minor axis tOt′ of the ellipse a t′*a t* is easily determined by taking the angle aO2, equal to the angle Ro2 (fig. 1), and drawing 2 t′ parallel to PP′.

I proceed to give a brief description of the geometrical processes involved in the construction of the figures of plates i. to xiii. of my "Seasons Pictured," conceiving that these processes may have an interest for the mathematical reader.

Describe a circle, aPa' (fig. 3), to represent the outline of the disc, and take the angle aOP, equal to the obliquity of the ecliptic (or nearly 23° 30′). Draw Po at right angles to aO, and describe the arc PL with centre o and radius oP. On this arc take the angle PoL, equal to the angle described by the earth around the sun from the vernal equinox, at the moment considered. (For instance, for the five sun-views one month after the equinox in my "Seasons Pictured" the angle would be 30°; for those one month before the Midsummer solstice the angle would be 60°; and so on.) Then LP, drawn at right angles to oP, gives P the pole of the earth. Thus POP' is the polar axis, and EOE′ at right angles to POP' is the major axis of the ellipse which will represent the equator. The half-minor axis Oϵ is equal to LP.*

To describe an ellipse, having given axes, is a very simple matter. Since it is necessary, for our purposes, that we should have *longitude-circles* as well as *latitude-parallels*, the following method, which gives points of both curves at once—that is to say, gives the points where the longitude-circles and latitude-parallels we wish to draw, intersect—is the most convenient:—

A circle, of which ϵM is a quadrant, is described round O as centre with radius equal to PL. The quadrant Ep' is divided into three equal parts in e_1 and e_2; and lines are drawn from O to these points, meeting the quadrant ϵM in f_1 and f_2. Then lines $e_1\epsilon_1$, $e_2\epsilon_2$, parallel to PP', and lines $f_1\epsilon_1$, $f_2\epsilon_2$, parallel to EE′, give by their intersection the points ϵ_1 and ϵ_2, on the ellipse representing the equator, and *also* on the longitude-circles we require.

To determine the ellipse corresponding to another parallel originally appearing as the line cnc′, a very similar method is available. The line nn parallel to Po gives the point n on OP, which is the centre of the ellipse we require; CnC′, equal in length to cc′, and at right angles to (and bisected by) PP', is the major axis; and since it is clear that this parallel, being (as its name implies) parallel to the equator, must be opened to exactly the same proportional extent, we get the half-minor axis $n\kappa$ by drawing the line Cκ parallel to Eϵ. Describe circles of which CG and $l\kappa$ are quadrants, and divide the quadrant CG into three equal parts in 1, 2, as in the former case; then, the lines n 1 1, n 2 2, being drawn, the lines through 1 1 and 2 2 parallel to the axes give the points κ_1, κ_2, on the ellipse and also on the longitude-circles we require. The quarter-ellipses Cκ, Eϵ, and the arcs $\kappa_1\epsilon_1\gamma_1$, $\kappa_2\epsilon_2\gamma_2$, of the two ellipses representing the longitude-circles we require, may now be drawn in: and by carrying on this process for other latitude-parallels and longitude circles we get the complete sets of lines shown in the figures of my "Seasons Pictured." The quarter-ellipses ϵE′ and κC′, the portion of an ellipse $l\kappa'l'$ beyond C and C′, and $\kappa_3\gamma_3$, $\kappa_4\gamma_4$, parts of longitude-circles crossing these, are added to show the relation of that part of the construction which has been gone through to the complete figure. It will be gathered that the construction of the figures of my "Seasons Pictured" has involved some degree of care and labour—a point which I only mention because those figures have been spoken of as if they had been drawn freehand.

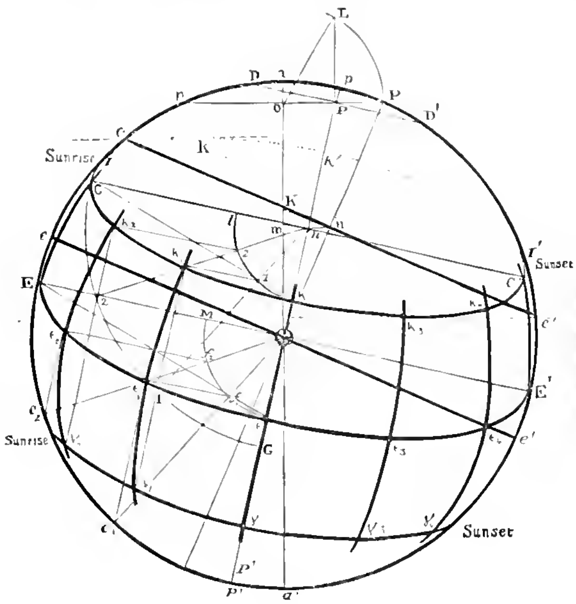


Fig. 3

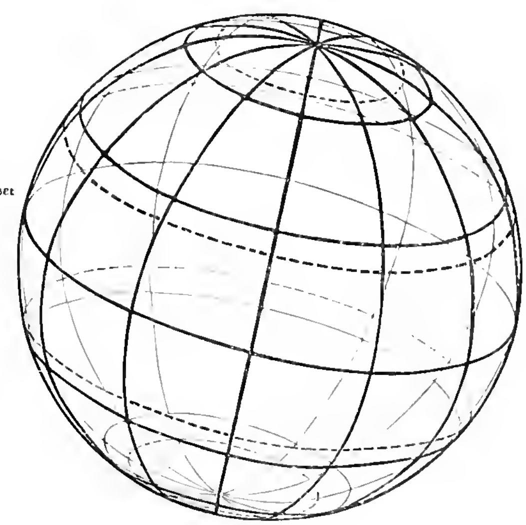


Fig. 4.

Of course, the careful construction of the ellipse CκC′κ' would give correctly the points l and l' in which this ellipse meets the circle aEa'E′—points corresponding to the place of sunrise and sunset for places on the latitude-parallel CC′. But it is well to determine these important points by a construction founded on the following simple considerations. Since it is clear from what has been said about straight lines passing through aOa' that the plane of the latitude-parallel cc′ (fig. 1) always meets Oa in the same point K (fig. 3), and since the line of intersection of this plane with the *plane* aEa'E′ must be parallel to the line EOE′ (which is the intersection of the plane of the equator with the plane aEa'E′), the line lKl' parallel to EOE′ is

* This is easily shown; for the globe may be supposed to have assumed its present position (with $PO'P'$ for polar axis) by having been rotated about EOE′ in such a manner that P moved along the *arc pP* (the foreshortened view of an arc equal to pD′ or pD obtained by drawing DPD′ at right angles to OP). By this motion the equator, originally seen as a line EOE′, would open out into the ellipse EϵE′, and, since the *arc* Oϵ would necessarily be the same as the arc pD, the *line* Oϵ would clearly be equal to PD. But PD is equal to PL, since (by Euc. III., 3) the square of either of these lines is equal to the rectangle pP,PP.

the line of intersection of the latitude-parallel c c′ with the plane aEa'E′; and the points I, I', thus determined are clearly those we require. For only that part of the latitude-parallel CC′ which lies on the nearer half-globe can be visible, and the circle aEa'E′ separates the visible from the invisible hemisphere.

Fig. 4 is added to show the appearance of a transparent globe traced with latitude-parallels and longitude-circles, and presented in the same way as fig. 2, which is also the presentation dealt with in the constructions illustrated by fig. 3.

Gossip.

READERS of KNOWLEDGE are requested to alter the words "It is" at the beginning of the foot-note on p. 227 of the August number into "Is it," altering the full stop after "folio" into a note of interrogation. "Benvolio" suggests in that note the possibility that, after all, the passage regarded as unmistakably corrupt may be as Shakespeare wrote it, and that Mrs. Quickly actually said, "his nose was as sharp as a pen and a table of green fields." Put it the other way, says "Benvolio," and it has as much sense in it as most of the things said by Dame Quickly have: "his nose was a tablet of green fields and as sharp as a pen." The reading, "a babbled of green fields," would be better for a Desdemona than a Dame Quickly.

* * *

ANOTHER mistake, for which my writing was, I fear, responsible, occurs near the end of the fourth section of the August "Gossip," where "the familiar Peter Williams" replaces "the familiar Peter Wilkins." I know of no Peter Williams, and therefore to me, at any rate, the name is not familiar. Peter Robinson and Jack Robinson are as familiar as Peter Wilkins, though not quite in the same way, while Robinson Crusoe is as familiar in a very similar fashion. But Peter *Williams* is as much out of the way as *Robertson* Crusoe would be.

* * *

I HAVE received from Mr. J. Fraser a copy of his pamphlet noticed at page 236, with a letter indicating the author's belief that the notice is unfair. That the notice is intentionally unfair, I can most emphatically deny, for though I did not myself write it, I know the author, and that he is incapable of the deliberate injustice imputed to him. I had myself only glanced over Mr. Fraser's pamphlet, and had come to the same conclusion as the notice indicates, viz., that Mr. Fraser suggests "heat" as the true explanation of gravity, an idea which led me to close the pamphlet with the remark, "*That* won't do." For we know the rate at which heat travels, and this velocity is quite insufficient to account for the instantaneous transmission of the action we call gravity, while also, though Mr. Fraser may have conditioned that heat shall not act in the proportion of sectional area, heat could not fulfil Mr. Fraser's condition, but must act as the notice of his pamphlet said. If I can find time to peruse Mr. Fraser's pamphlet (I use the word "peruse" here instead of "read" of set purpose), and can find that he really does guard his theory against the objections mentioned in the notice, I will state as much very willingly in these columns. But, in the meantime, I would beg Mr. Fraser to dismiss the notion that he has been treated with wilful unfairness.

* * *

I DO not know what particular form the explanation of gravity took in Mr. Kedzie's book mentioned in the notice of Mr. Fraser's, but, from the account, it is the old old explanation, according to which, particles travelling with infinite velocity in all directions fall on bodies except where shielded off by other bodies, and this again emphatically will not do. If gravity is to be explained at all, it must be by some form of energy transmitted from every particle of everybody's mass, with a rapidity incomparably exceeding the velocity of light.

* * *

SPACE compels me to keep "Gossip" within very narrow limits this month. I shall invite the attention of readers of KNOWLEDGE, however, to the announcement which appears in slip form among the advertisements. It will be observed that the book on astronomy there announced will be very much larger and more fully illustrated, in proportion to its price, than any book of the same class yet published. But I can promise that it will be larger still and more fully illustrate if an adequate number of subscribers should justify the additional expense. I have long regarded it as a mere farce, and an unfair one at that, to offer for 31s. 6d. a book of only some 600 ordinary octavo pages, even though the name of an observatory astronomer is on the title-page, who, if earning his salary, cannot possibly have had time either for the reading or for the independent researches necessary for the production of an original treatise on general astronomy.

Reviews.

Anything that reaches us from the pen of Dr. Geikie must be good, and his last little work only emphasises this fact. *The Teaching of Geography* (Macmillan, 2s.) is an introductory essay prefacing a series of manuals in that subject promised by that enterprising firm. The book is intended directly for teachers, and only indirectly for the pupil. It systematises in Professor Geikie's masterly way the methods by which the subject may become a valuable educational instrument. It is a work much needed; whether it will succeed is another question, which we should hesitate to answer in the affirmative quite so readily. The great majority of schoolmasters outside the class of elementary teachers hardly know how to teach at all. As Dr. Abbott observed recently, a brass plate, and a preliminary failure in some other occupation, with, perhaps, the easily obtained but imposing letters M.C.P. or F.R.G.S., form to them a sufficient stock-in-trade. Still, there are some teachers really in earnest in their work, to whom geography is not topography only, and we cordially invite them to peruse this book. In skilful hands the subject may be made a capital training for the young. The large class of young elementary teachers studying at college and elsewhere how to do their work will doubtless use the book in their course. It will unquestionably improve their knowledge of method.

Greek Verbs in a Fortnight, by JOHN CAREY, B.A. (Swan Sonnenschein & Co., 1s. 6d.), is a fairly successful attempt, by tabulation and generalisation, to shorten the time usually wasted in learning the Greek verb. We think it likely to be of use to older boys rather than to young pupils.

The *Exercises in Word Formation and Derivation*, by FRANK RITCHIE, M.A. (Sonnenschein), if time would allow of its use in schools, would infuse a little useful variety in the English grammar lesson. Word-building is one of the best mind-expanding processes, especially with young pupils. They enter into it with immense interest, and retain much. The exercises upon derivation from the Latin and Greek would suit older boys who have begun the study of those languages; but for those who have not, we think time might be much better employed. The last few exercises on correlation, distinctions, synonyms, and references in phrases and words, will severely test the knowledge of not a few teachers.

D. MAUER'S *New Mode of Geometrical Demonstration* (Brown, Aberdeen) is ingenious and worthy of a perusal.

The Commonhealth. By BENJAMIN WARD RICHARDSON, M.D., F.R.S. (London: Longmans, Green, & Co. 1887.)—The extent to which we hold our health—nay, the duration of our very lives—in our own hands is in no way more forcibly illustrated than by the returns of mortality issued by the Registrar-General; and, to take a simple illustration, the comparison of the death-rate in the metropolis in 1827 with that in 1887 can scarcely fail profoundly to astonish any one who makes it for the first time. Dr. Richardson is among the best known of our sanitary reformers, and, if we are sometimes tempted to credit him with an amount of enthusiasm and optimism not wholly according to knowledge, no one can deny or ignore the yeoman's service he has done towards improving the health of his fellow-countrymen. His latest volume, of which the title heads this notice, consists of a collection of essays and addresses, most of which have previously been delivered in public, but one and all of which are well worthy of perusal in their collected form. Very notably is this the case with regard to his "Essays on Education," the common-sense of his remarks on the School Board system commending itself to every one not afflicted with our present Chinese craze for cramming and competitive examination. Dr. Richardson's papers on "Diseases incidental to Public Life"; "Woman as a Sanitary Reformer"; "Dress in relation to Health"; and "Cycling as a Health Pursuit" must each appeal to a large circle of readers. That on "Upper and Lower London," of all those in the volume, appears to us a little too Utopian.

History of the Boers in South Africa. By GEORGE MCCALL THEAL. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—We have only to read any Parliamentary debate on our South African difficulties during the past few years to be convinced how curiously ignorant Englishmen, as a rule, are of the true history and present condition of affairs in the vast country or countries surrounding our colony at the Cape. We welcome, then, a history of people with whom our relations have been so largely of a hostile character, written by an impartial observer, with neither party ties nor prepossessions to warp his judgment. In fact, it is the rigid impartiality of Mr. Theal's book which constitutes its chief value, and imparts to it its highest interest. While he recognises the value of missionary effort, the missionaries themselves, as depicted in his pages, certainly would not seem to be fairly describable in the words of Malachi, ii. 6; while, as for the Boers, many of their utterances, even in public documents, evoke irresistible reminiscences of the exclamation of the Irishman: "Dthrunk or sober, thank the Lord, no one niver gat the thruth out o' me!" Mr. Theal has made an addition of real value to our knowledge of the existing state of Southern Africa, and a study of his pages might even conceivably enable us to avoid one of the wretched little wars which are imminent wherever civilised and semi-civilised or savage races are conterminous.

A Misunderstood Miracle. By Rev. A. SMYTHE PALMER, B.A. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—Here is a melancholy instance of time wasted and scholarship perverted in an attempt to explain the mythical legend in Joshua x. 12–14. Verily Mr. Palmer's title is an appropriate one, inasmuch as we can scarcely conceive any much more serious misunderstanding of this story than to regard it as the record of a miracle at all. We wonder whether the author of this little book has ever reflected on the impious audacity of supposing that the Infinite Author of the Universe would suspend the inexorable laws of Nature in order that one semi-savage tribe might the more effectually slaughter another in a valley in a corner of Asia. Presumably Mr. Palmer preaches the doctrine of forgiveness of our enemies, the while illustrating the justice of the command by the assumption that He who uttered it darkened the very sun in the sky, that He might exterminate those who offended Him! This is playing into the hands of "Saladin" and Company with a vengeance.

The Temperaments: their Study and their Teaching. By ALEX. STEWART, F.R.C.S. Edin. (London: Crosby Lockwood & Co. 1887.)—Inasmuch as the word "temperament" is often employed in a manner or sense in which it can only be regarded as a solecism. Mr. Stewart, who is clearly an enthusiast on his subject, has set himself rigidly to define the four orthodox "temperaments" (the Sanguine, the Bilious, the Lymphatic, and the Nervous) and their various combinations; to indicate by what external physical signs their existence may be inferred; and to show in what manner intellectual capacity and character are modified by them. In a tabular "scheme" of the four simple temperaments, our author sets forth in parallel columns the physical and mental characteristics which distinguish them; and subsequently shows how combinations of these temperaments give rise to corresponding changes both in mind and body. Illustrations in support of his contention are derived by Mr. Stewart from various eminent men and women, some of whose portraits appear in the plates bound in with the book. That a large substratum of fact underlies his hypothesis can scarcely be doubted; and assuredly the study of the temperaments must be at once a more profitable and scientific one than an investigation of the vagaries and puerilities of cheiromancy, which is—or has recently been—so fashionable. A good deal of information of an odd and out-of-the-way kind, to say nothing of amusement, may be gathered from the pages before us. The book is beautifully printed and got up.

Outlines of Quantitative Analysis. By A. HUMBOLDT SEXTON. (London: Charles Griffin & Co. 1887.)—In this unpretending little volume Mr. Sexton introduces the student who has familiarised himself more or less with qualitative analysis to the more practically useful and interesting methods of analysing both organic and inorganic substances quantitatively. His directions are simple and perspicuous, and his illustrations sufficiently numerous and good. It is well suited to its purpose.

The Theories of Anarchy and of Law: A Midnight Debate. By H. B. BREWSTER. (London: Williams & Norgate. 1887.)—What Goldsmith said of Johnson—that he made his little fishes talk like whales—is applicable, to a considerable extent, to the author of the curious book whose title heads this notice. Certainly Mr. Brewster would have secured more attention and consideration for his views had he cast his dialogue in a somewhat less pedantic and academic form: for surely no four living men ever talked for the hour together in the stilted periods and with the scholastic diction of his interlocutors, Ralph, Wilfrid, Lothaire, and Harold. We must refer the reader to the book itself for its author's theory of life and ethics, and leave him, or her, to decide how far the reduction of that theory to practice would conduce to the happiness of mankind at large.

Gleanings in Old Garden Literature. By W. CAREW HAZLITT. (London: Elliot Stock. 1887.)—All lovers of the innocent pleasures of a garden will revel in Mr. Hazlitt's quaint and curious extracts from forgotten horticultural literature. Of course, Evelyn, Bacon, Sir William Temple, and other owners of famous gardens figure largely in his pages, and much interesting information will be found as to the early cultivation in this country of vegetables now procurable by, and familiar to, the very poorest of the population. It is strange to read of the market-gardens at Battersea, and of the nursery-grounds at Brompton (existing during the memory of many who will read these lines), where miles of streets, crescents, "gardens," and squares now cover the ground. Something will be found in Mr. Hazlitt's pages to interest every one, from the owner of the lordly garden, with its acres of glass, to the possessor of a window-box full of mignonette or tropæolum.

The Fungus-Hunter's Guide and Field Memorandum Book. By W. Delisle Hay, F.R.G.S. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—In the handy little volume before us Mr. Hay gives descriptions, amply illustrated, of all the British fungi, interleaving it with ruled paper for notes and memoranda in the field. By means of two "keys" prefixed the order and genus of any fungus may be found, and then in the list of genera the "find" may be hunted down. A valuable feature in Mr. Hay's book is the distinction of fungi into esculent, doubtfully esculent, poisonous, supposed to be poisonous, and unknown. No one who will carefully note the letters appended to the description of each species can have the slightest excuse for eating even an unwholesome kind of fungus, and on this ground alone the work may be commended to the gourmet as well as to the scientific botanist.

Hungary. By Arminius Vambéry, with the collaboration of Louis Heilprin. (London: T. Fisher Unwin. 1887.)—If ever the history of a country could be epitomised in the phrase of our liturgy, "Battle, murder, and sudden death," it would be that of Hungary, as narrated by Professor Vambéry in the new volume of the "Story of the Nations" series now before us. From the date of the conquest of the Pannonians by Tiberius down to the days of Kossuth, Görgei, and Batthyáni, war, civil or exotic, slaughter, and rapine appear to have formed the chronic conditions of existence of the inhabitants of the country to the west of the Carpathian Mountains. The patriotism, not to call it the partisanship, of Professor Vambéry lends a colouring to the whole narrative; and the reader will scarcely be surprised to find what is praised in the Hungarian as bravery and justifiable artifice denounced as cruelty and treachery when practised by his enemies. But, allowance made for this, the student of history will find in the work before us an interesting account of the persistent struggles for freedom of a most gallant and interesting nationality.

Boys and Masters. By A. H. Gilkes, M.A. (London: Longmans, Green, & Co. 1887.)—Mr. Gilkes calls "Boys and Masters" "a story of school life," but there is an amount of imagination in this description which is not always to be found in a narrative whose distinguishing feature is its exiguity. Certainly Mr. Gilkes's boys are very natural boys, and many of us will excite or revive reminiscences of our own school and schoolfellows in reading of their sayings and doings. Presumably, too, the masters are equally natural as depicted when, so to speak, off parade; but of this, for obvious reasons, we can speak less confidently. Apparently Mr. Gilkes's aim seems to be to insist upon the responsibility of parents in connection with the education of their children; but, if so, pretty sustained attention is needed to discover it. Whether it was the *spretæ injuria formæ* that drove Dr. Scott to resign his mastership, or what, we are as ignorant now as we were before we opened the book.

Matter and Energy. By B. L. L. (London: Kegan Paul, Trench, & Co. 1887.)—"What," asked *Punch*, in his imperishable epitome of metaphysics, "is mind? No matter. And what is matter? Never mind." Pursuing a parallel path, "B. L. L." regards matter as a mere figment of the imagination, and energy as the sole entity in the universe. We wholly fail to see upon what ground our author would be justified in predicating the objective existence of his father and mother, who must, upon his showing, be simply resolved into a bundle of his own sensations and into nothing else in the world.

England's Ideal, &c. By Edward Carpenter. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—This mass of Communistic trash is pretty obviously the work of a man who, failing to emancipate himself from his own social stratum, proposes to regenerate society by dragging everybody down to his own level. The author's ignorance of the manners, customs, and modes of thought and feeling of the classes he so scurrilously abuses would be ridiculous were it not so utterly contemptible. This is a species of literature which may suit such as can read of the drunken loafers who follow Hyndman, Champion & Co. into Trafalgar Square, but can only excite disgust in, and wholly repel, any tolerably educated, fair-minded Englishman, be his social rank what it may.

The London Weather Chart, 1887. By B. G. Jenkins, F.R.A.S. (London: R. Morgan.)—Mr. Jenkins appears to us to be, as nearly as may be, as often wrong as he is right, which is only another way of saying that his predictions are made upon no sound scientific principle whatever. Taking the month in which this is written (August) he summarises his expectations thus: "Barometer rather low first half of the month" (up to the 13th it was really very high), "bringing rain and decrease of temperature" (the protracted drought and great heat must be fresh in the memory of all our readers). "Violent gale probably about the 4th" (no gale whatever happened; there was a thunderstorm on the 15th–16th). So far Mr. Jenkins was ludicrously wrong. "Fine the last half of the month, with, however, rain towards the close," represents a little, and only a little, more accurately what really occurred. Now, if Mr. Jenkins's predictions had proved correct in any considerable majority of cases the presumption would be that he really had hit upon the law governing the weather of the metropolis. On the other hand, if he were persistently wrong, it would appear that he was on the track of *a* law, but had mistaken its signification. When, however, he is, as we began by remarking, about half wrong and half right, the conclusion is irresistible that his vaticinations are about as valuable as those of Murphy or Zadkiel, neither more nor less so.

The Management of the Eye, Ear, and Throat. By Henry Power, F.R.C.S., George P. Field, and John S. Bristowe, M.D., F.R.S. *The Management of the Skin and Hair.* By Malcolm Morris, F.R.C.S. Edin. (London, Paris, New York, and Melbourne: Cassell & Co.)—These two valuable little books are reprinted from that large and elaborate work, "The Book of Health," issued by the same publishers; and may be confidently recommended as thoroughly trustworthy guides to the self-management of those organs of the human body of which they respectively treat. On the importance of the preservation of sight, hearing, and speech throughout life, it would be idle to insist; and the non-professional reader will find in the first volume of those whose titles head this notice, the plainest and most explicit directions for that purpose. Mr. Malcolm Morris's work should in addition become popular with the fair sex, inasmuch as in the skin and hair reside some of the most striking and important elements of female beauty;

and ladies will find a quantity of information which cannot fail to be of value to them between its two covers. To follow Mr. Morris's injunctions in their integrity should insure a clear complexion and abundant tresses at an age when, alas! but too many have fallen hopelessly into the hands of the cosmetique makers and friseur; and on this ground alone his small volume may be commended to all who wish to preserve their original charms undimmed.

Syllabus of Elementary Geometrical Conics. (London: Swan Sonnenschein, Lowrey, & Co.)—This small volume is issued by the Association for the Promotion of Geometrical Teaching, and will be found handy by the student as an aid to memory.

The Watch-Jobber's Handbook. By Paul N. Hasluck. (London: Crosby Lockwood & Son. 1887.)—This latest of Mr. Hasluck's thoroughly practical little books will be found very handy as a book of reference by country watchmakers in out-of-the-way places, and by learners and apprentices everywhere. In point of fact, any amateur mechanic familiar with the use of tools ought, after a careful study of this volume, to be able to clean and adjust any ordinary horizontal or lever watch, though probably a chronometer or duplex one might prove a little beyond his capacity. The first forty-nine pages of the work are devoted to a detailed description of the methods of cleaning, repairing, and adjusting watches, the remaining ninety-one being devoted to a profusely-illustrated glossary of technical terms, something like that contained in Mr. Britten's well-known book. There is a very good index to it.

Black and White. Nos. 6 and 7. (Manchester: 1887.)—A weekly illustrated pennyworth, with lithographed portraits of famous cricketers and more or less artistic landscapes. "Daisy Nook" belongs to the former class.

A Lecture . . . on Diseases of the Hair: and a Lecture on Baldness and Ringworm. By James Startin. (London: Harrison & Sons.)—We are glad to find a man of Mr. Startin's eminence delivering the two lectures reported in this little pamphlet to the Hairdressers' Guild, and it is much to be hoped that it will also be read by those upon whom the members of the said guild operate. Certainly, were any hairdresser to imagine a customer to be familiar with its contents, he would think twice before telling that customer what a member of the craft not many years ago assured the present writer, that plenty of people who found Sir Erasmus Wilson's prescriptions fail had been cured of baldness by the application of his "Balsam of Ecbatana" (or some such rubbish)!

A B C Five-Figure Logarithms. By C. J. Woodward. B.Sc. (London: Simpkin, Marshall, & Co.)—This is a very handy little book indeed, containing the logarithms of numbers from 1 to 9999 to 5 places of decimals, with analytical factors, and other tables useful in the laboratory. The differences in Table I. are arranged on a simple plan, and the tables themselves are indexed, ingeniously enough, ledger fashion, so that the finger being placed upon the index of the page required the book opens at it at once.

Intelligence in the Van. By Horace Dobell. M.D. (London: Wertheimer, Lea, & Co.)—The visible Universe had its origin in "Potentia." When poor creatures like Darwin, Huxley, Romanes, and their fellows assert that mind is a development as much as man's material organisation, and that it has passed through its successive stages from the lowest to the highest, they talk nonsense, because Dr. Dobell knows better. Vitality was one of the modes of Potentia, and so the world became peopled with life; with voluntary locomotion came mind, and mind in man assumed the mode of soul. Every animal possesses aspiration, but in the lower animals it is directed objectively. Directed subjectively in man it becomes soul. Professor Romanes weakly traces the development of mind from reflex action through instinct to intelligence or reason. Dr. Dobell says, No. The order must be reversed, and we must have intelligence in the Van. Hence the title of his tract. We can only trust that the reader follows the line of argument. If we may borrow a piece of American slang, Dr. Dobell's appears to be a very "one-horse" Van, placed studiously before the animal which should draw it.

Mechanical Dentistry. By Charles Hunter. Third Edition. (London: Crosby Lockwood & Co. 1887.)—That this volume of "Weale's Series" should already have run into a third edition affords a tolerable indication of its use and value to the dental profession. Moreover, at a time when a leading dentist has cheerfully declared that, fifty years hence, not a man, woman, or child in the United Kingdom will have a sound tooth in his or her head, it may not be wholly uninteresting to the general public to learn something of the elaborate mechanical devices employed (as Mr. Samuel Weller observed) "to assist Natur'" when their normal masticatory apparatus fails them.

Mr. W. H. Collins sends us *A Proposed Alteration in the System of Playing off Minor Events in Lawn-tennis Tournaments*, which he thinks will be fairer to those who compete for prizes. It seems decidedly more complicated than the existing system.

The Mammoth and the Flood. By H. H. Howorth, M.P., F.S.A. (Sampson Low & Co.)—This book is dedicated to the Duke of Argyll, who is just now cock-a-hoop at the discovery that Darwin's theory of the formation of coral islands has been disproved by the researches of the *Challenger* naturalists, and who consequently thinks that the whole theory of the origin of species is on its last legs. *Ex pede Herculem.* Mr. Howorth is fighting shadows, bringing needlessly heavy and cumbersome artillery in the shape of this big volume against uniformitarianism. The quotation which he gives from Professor Huxley as to the place of "catastrophes" as part and parcel of the uniform operation of agencies varying in degree and intensity of action disposes of the matter, and we therefore think that the author has wasted abilities which, as his valuable "History of the Mongols" shows, are of no mean order. We are none the less glad to have his collection of legendary and true materials concerning the mammoth gathered together, but we fail to see that the positions of the skeletons of that last of man's contemporaries among the larger mammals warrants the author's inference of a universal flood. The geological evidence in support of this is, however, reserved for publication in another volume.

Saga Time. By J. Fulford Vicary. (Kegan Paul, Trench, & Co.)—We regret to learn that the author of this clear and lively account of the men who wrote the famous Sagas and of the leading Sagas themselves has passed beyond the sound of the critic's praise or blame, and the more so as we can speak well of the way in which he has discharged his task. He has caught the spirit and temper of the stirring times described, when life was an unending battle and feasting bout; the Sagas, with their tales of king, courtier, warrior, thrall, and freeman, woven deftly by the honoured skalds, the insight which they give into law, custom, and belief are all set before us in unaffected and vigorous English. The general sketches are followed by a careful and useful abstract of the Volsunga-Saga. If it lacks the pleasant archaic flavour of Cox and Jones's summary in their "Popular Romances," it gives the reader compensation in the explanatory matter embodied in it. Altogether the book is one to be heartily commended to the student of Northern life and custom as a sound and trustworthy introduction to subjects exhaustively treated in works like the "Corpus Poeticum Boreale" of York Powell and Vigfusson.

Animal Biology. By C. LLOYD MORGAN. (Rivingtons.)—This is a thoroughly practical book, sufficient for the medical student, for whom it is primarily intended, and, withal, untechnical enough to be enjoyed by the general reader. Acting on the sound principle that when once the form and function of a given organism have been mastered its relation or unrelation to large groups is clear, the author selects typical representatives of each sub-kingdom, illustrating his expositions by diagrams, which are to be preferred to pictures in all guides to laboratory work.

The English Illustrated Magazine, 1886–87. (Macmillan & Co.)—The present volume fully maintains the high level of its predecessors. The delicacy and, withal, vigour of the woodcuts evidence that our engravers need not fear the competition of their American rivals. As for the letterpress, it suffices to say that B. L. Farjeon, Marion Crawford, Grant Allen, and the late Richard Jefferies are among the contributors.

Messrs. Longmans send us a cheap edition of that lively story of travels, *Three in Norway*, by TWO OF THEM, on which the public has wisely set its seal of approval. Messrs. Blackwood have issued the twelfth edition of the late DAVID PAGE'S *Introductory Text-book of Physical Geography*, to which Professor W. D'Arcy Thompson adds a revised chapter on animal and plant distribution.

We have also to acknowledge the current issues of *Longman's Magazine*, with a pleasant paper on "Independent Travelling," by Mr. HAMERTON, and the opening chapters of a new story by the fecund author of "Mehalah"; of the *Century*, *St. Nicholas*, and the *Westminster Review*, which has an article on the poetry of George Meredith, inviting attention to works which his prose tends to obscure. Travellers to the Ardennes should put PERCY LINDLEY'S *Walks* (W. H. Smith & Son) in their pockets, as a guide-book worth six shillings instead of the sixpence it costs; and our microscopist readers may be reminded that Mr. COLE'S *Microscopical Science Studies* (Hammond & Co., Birmingham) continue to merit their support. They will be worth keeping.

THE FACE OF THE SKY FOR OCTOBER.

By F.R.A.S.

THE outburst of solar activity to which reference has more than once been recently made here seems to have subsided, and sun spots are now few, small, and infrequent. The zodiacal light is visible before sunrise in the east. The night sky is delineated in map x. of "The Stars in their Seasons." Minima of Algol. ("The Stars in their Seasons," map xii.) will occur at 12h. 50m. P.M. on the 3rd, at 9h. 39m. P.M. on the 6th, at 6h. 28m. P.M. on the 9th, at 11h. 21m. P.M. on the 26th, and at 8h. 10m. P.M. on the 29th, and at other times more inconvenient for the amateur observer. Mercury is an evening star all through the month, and attains his greatest eastern elongation from the sun (23° 48′) in the early morning of the 27th. He is too near the horizon now, though, especially towards the end of the month, for the observer to have any reasonable chance of seeing him. Venus is a morning star throughout October. She attains her greatest brilliancy on the 28th, and, should the sky be sufficiently clear about that date, may be caught with the naked eye in bright sunshine, by any one who knows exactly where to look for her. She exhibits a beautiful crescent in the telescope. Neither Mars nor Jupiter are, for the purposes of the ordinary amateur observer, visible. Saturn is a morning star; he rises at midnight at the beginning of October, and soon after 10h. P.M. at the end of it. His ring system is sensibly the same as it was on his departure early in the year. He will be found below the Præsepe in Cancer ("The Stars in their Seasons," map ii.). Uranus is invisible, coming, in fact, into conjunction with the sun on October 6. Neptune may be seen before midnight, in that void part of the sky south of a line joining the Pleiades and γ Tauri ("The Stars in their Seasons," map. xii.). He looks like a 7–8th magnitude star, but shines more steadily than any in the neighbourhood, and is of a slightly bluish tinge. The moon is full at 3h. 47·3m. A.M. on the 2nd, enters her last quarter at 4h. 57·4m. A.M. on the 10th, is new at 10h. 35m. on the night of the 16th, enters her first quarter at 5h. 45·8m. P.M. on the 23rd, and is full for the second time this month at 9h. 30·9m. at night on the 31st. High tides may be looked for on the 16th and 17th. No less than eleven occultations of fixed stars by the moon occur at convenient hours during the present month. On the 6th, 75 Tauri, a star of the 6th magnitude, will disappear at the bright limb of the moon at 10h. 45m. P.M., at an angle from her vertex of 102°. It will reappear at her dark limb at 11h. 39m. P.M., at an angle of 215° from her vertex. On the same night θ^1 Tauri, of the $4\frac{1}{2}$th magnitude, will disappear at the bright limb at 10h. 51m. at a vertical angle of 350°, reappearing at the dark limb at 11h. 8m., at an angle of 325° from the vertex of the moon. Later still B.A.C. 1391, of the 5th magnitude, will disappear at the bright limb at 11h. 45m. at an angle of 29° from the moon's vertex; and will reappear at her dark limb at 12h. 40m. P.M. at a vertical angle of 295°. On the 8th 71 Orionis, a $5\frac{1}{2}$th magnitude star, will disappear at the bright limb of the moon at 11h. 56m. P.M. at an angle from her vertex of 59°, reappearing at her dark limb at 1h. 1m. A.M. on the 9th at an angle of 237° from her vertex. On the 23rd σ Capricorni, a $5\frac{1}{2}$th magnitude star, will disappear at the dark limb of the moon at 8h. 18m. P.M. at an angle of 113° from her vertex; it will reappear at her bright limb at 9h. 29m. P.M. at an angle from her vertex of 327°. On the 24th θ Capricorni will disappear at her dark limb at 4h. 32m. P.M. at an angle of 78° from her vertex, and will reappear at 5h. 52m. P.M. at her bright limb, at a vertical angle of 277°. On the 26th, 70° Aquarii, of the 6th magnitude, will disappear at the dark limb at 7h. 50m. P.M. at an angle of 88° from the vertex of the moon; its reappearance, 323° from the lunar vertex, occurring at 9h. 7m. P.M. On the 28th B.A.C. 81, of the 6th magnitude, will disappear at the moon's dark limb at 11h. 32m. P.M. at an angle from her vertex of 85°. It will reappear at her bright limb 21 minutes after midnight, at an angle of 12° from her vertex. On the 29th three occultations will happen, 26 Ceti, of the $6\frac{1}{2}$th magnitude, disappearing at the dark limb of the moon at 7h. 22m. P.M. at an angle of 87° from her vertex, and reappearing at her bright limb at 8h. 37m. P.M. at an angle from her vertex of 274°. Next, at 10h. 40m. P.M., 29 Ceti, also of the $6\frac{1}{2}$th magnitude, will disappear at the dark limb at an angle of 141° from the vertex of the moon; and will reappear at 11h. 57m. P.M. at her bright limb at an angle of 294° from her vertex. Thirdly, 33 Ceti, a star of the 6th magnitude, will disappear at the dark limb at 12h. 58m. P.M., 193° from the moon's vertex. Its reappearance does not occur until the next morning. We have said above that these eleven occultations occur at convenient hours; but there is a twelfth which it is well worth the while of the amateur to get up—or sit up—to observe. We refer to the occultation of Aldebaran during the early morning of the 7th. On that day, at 3h. 20m. A.M., the star will disappear at the moon's bright limb at an angle from the vertex of 42°, its reappearance occurring at 4h. 2m. A.M. at the dark limb at a vertical angle of 354°. The student will not forget that this is the star which has been seen on more than one occasion to be apparently projected on to the bright disc of the moon. At noon to-day the moon is in Pisces ("The Seasons Pictured," plate xxii.), and in the course of two or three hours passes into the confines of Cetus, from which she emerges in Pisces again at 4 P.M. on the 2nd, only, however, to re-enter the most northerly portion of Cetus at 9 P.M. on the 3rd. When she finally quits this constellation at 10 P.M. on the 4th it is to enter Aries. Her passage through the remaining part of Aries is accomplished by 4h. 30m. P.M. on the 5th. She then crosses into Taurus ("The Seasons Pictured," plate xxiii.), and travelling through it, arrives at 3h. P.M. on the 8th at the western edge of the northern prolongation of Orion. She takes just twelve hours to cross this, and at 3h. A.M. on the 9th quits it for Gemini ("The Seasons Pictured," plate xxiv.). Her journey through Gemini ends at 10h. P.M. on the 10th, and she then passes into Cancer. She remains in Cancer until 10h. A.M. on the 12th, and then crosses into Leo. Leo she leaves for Virgo at 9h. 30m. P.M. on the 14th ("The Seasons Pictured," plate xxv.), and Virgo in turn for Libra at 6h. P.M. on the 17th ("The Seasons Pictured," plate xxvi.). Journeying through Libra she reaches at 9h. A.M. on the 19th the narrow northern spike of Scorpio. By 5h. 30m. P.M. on the same day she has traversed this and come out in Ophiuchus. Here she remains until 8h. A.M. on the 21st, when she crosses the boundary into Sagittarius. By 4h. P.M. on the 23rd her passage through Sagittarius is ended, and she has entered Capricornus

("The Seasons Pictured," plate xxi.). She leaves Capricornus for Aquarius at 6h. P.M. on the 25th, and Aquarius for Pisces at 9h. P.M. on the 27th ("The Seasons Pictured," plate xxii.). After this, as at the beginning of the month, she is skirting the confines of Pisces and Cetus, being sometimes in one constellation and sometimes in the other, and it is not until 6h. P.M. on the 31st that she finally enters Aries again ("The Seasons Pictured," plate xxiii.). She is, of course, still in Aries at midnight on that day.

Our Whist Column.

By "Five of Clubs."

MATHEWS ON WHIST.

Rearranged, partly rewritten, and occasionally corrected in accordance with modern views.

Play Third Hand—*concluded.*

BE as careful what you throw away as of what you lead. It often leads to bad consequences to play a tray with a deuce in your hand. Thus, suppose your partner leads the four, your right-hand adversary the five, and you put down the tray, it ought then to be a certainty that you can ruff the next trick in the suit. [If, however, you hold the deuce, you not only cannot ruff, but as you are utterly weak, the lead of the suit by your partner is probably the worst thing he could have done.] If your partner finds the deuce in your hand, and you frequently deceive him in the same way, he loses all confidence in you, and is prevented from playing his game on similar occasions. I wish to inculcate to beginners special care in such points of whist play. Every one can attain these minor qualifications. When once the great advantage of correctness in such matters is recognised, the weakest player should strive as constantly as the strongest to attain it: attention only is necessary.

Play Fourth Hand.

With ace, knave, and another, do not win the king led by your left hand adversary. By passing it you either force him to exchange his lead or to give you tenace in his own suit. [Of course, if your right-hand adversary show signs of being short in the suit, or if a single trick makes or saves the game or a point, you should play the ace unhesitatingly. Cavendish considers it generally bad play to hold up the ace; but in the case considered by Mathews it is sound policy. Either the leader has great length in the suit or not: if he has, you have the greater reason to retain command over the suit as long as possible; if he has not, the chance of being ruffed on the second round is small.]

It frequently happens that by winning your partner's trick, when you are last player, you give him the advantage of tenace over your left-hand adversary. Thus A has king, knave (or any other second and fourth best cards), with a small one of the suit, of which Y, your partner, has the first and third and another. If A leads his small card, and Y, your partner, wins it with his small card, you, as last player, should win the trick if possible, though it is your partner's. For you thus prevent A from making a trick in the suit, which he must have done had you left the lead with Y.

Return Lead and Forced Lead.

With three, return the highest to your partner's lead. This answers two purposes: it gives your partner an opportunity to finesse, and it shows him that you held originally but three at most in the suit. With four or more, you should return the lowest.

If you win your partner's lead with the queen, do not return it (except in trumps); it is evident the ace and king are both behind you, and, since your partner certainly does not hold both, returning his lead gives the adversary the tenace.

It is generally right to return your partner's lead in trumps unless he leads an equivocal card,* such as a nine or ten [in which case, should you have reason to believe that the lead is from weakness, you exercise your own judgment as to the propriety of going on with trumps].

* So called because such a card may be led with propriety both from a strong and from a weak suit. For instance, with a quint to a king (that is, king, queen, knave, ten, nine), or with king, knave, ten, nine, nine is led; but nine is also led when it is the best of two or three in a suit. [So also ten is led from king, knave, ten with or without others, and from quart to king and one small card or more; but ten is led where it is the best of two or three.]

Beginners find it difficult to distinguish between original leads and forced leads. When a player changes his original suit, he commonly plays the best card of another, to give his partner the advantage of a finesse. To such a lead from your partner you should play as if it were your own or the adversary's: keep the commanding card, ten, ace, &c., and do not return it, as if it was an original lead.

If the fourth player wins the adversary's lead, it is better to return it than to open a new suit, unless you have such strength in this suit that you can support your partner. [You put your partner in a favourable position by returning the lead of the player on your left under such circumstances, especially if you are yourself short in the suit, and your right-hand adversary showed weakness in it. Even if the suit is ruffed on your right, you probably gain.]

When you have a moderate hand yourself, sacrifice it to your partner: if he is a good player he will act in the same manner towards you.

The Discard.

If weak in trumps, keep guard on your adversary's suits: if strong, throw away from them. [In these two rules, and in sixteen words, Mathews sums up the whole duty of the sound player in discarding.] Discard as much as possible from your partner's strong suits in either case. [Or rather, you can usually discard safely from your partner's strong suits, even at times throwing away commanding cards in it; you should be careful, however, to retain the means of leading to your partner in them, if necessary. In some cases you can with advantage throw away every card in your partner's best suit, obtaining thereby a chance of an effective ruff; but until you are sure he will be able to lead the suit himself, it is well to keep a small card or so in it to lead to him with.]

Observe carefully the original discard of each player, noting whether the discard is to the lead of the partner or the adversary of the player discarding. A discard to partner's lead is invariably meant to direct him; but a discard to a lead of an adversary is frequently intended to deceive the adversary, and induce him to lead his strong suit.

If your partner, to your winning card, throws away the best card of any suit, it shows he wishes you to know he commands it. If he throws away the second best, you may infer that he has no more.

Our Chess Column.

By "Mephisto."

ALTERNATION GAMES.

THESE games are played by four players, every person moving alternately, without consulting the other, as in the game printed below. If played quickly, these games afford a great deal of amusement to the players. The parties watch each other's play with a great deal of suppressed excitement, quite unusual in the ordinary game. Will my partner see my idea and make the right move? is always vividly impressed upon the countenance of the player who has just sacrificed a piece in a combination dependent for its success upon two or three subtle moves. The prohibition against consultation at such supreme moments is calculated to try the patience and shake the moral probity even of a saint. To stare intensely on a certain square of the board, to wriggle about impatiently on the chair, to cough when the ally is about to make the wrong move, and to communicate in all manner of ways to the partner, that a decisive combination is on, are expedients adopted by weaker mortals with not sufficient moral restraint. Such undignified conduct is unfair to the opponents, and would be painful if it were not comical. These visible and glaring attempts to infringe the law against communicating with your partner are, of course, unworthy of players of unimpeachable moral conduct: but, unfortunately, there still remains the invisible and stealthy kick under the table, to attract your partner's attention, and in certain positions I think even a saint would take to kicking, gently or viciously, as the occasion may require.

These games are very useful when two strong players are opposed to each other. The weaker partner will, in course of play, have many opportunities to see and appreciate thoroughly the superior ideas of his partner, and after the game he will have the advantage of being shown where and how he failed to pursue the right course. Having been engaged in thinking over the moves, he will be able to understand any subsequent analysis, and derive much benefit and instruction therefrom.

Alternation game played at the British Chess Club between Messrs. Harris and Gunsberg *versus* Messrs. Mills and Newnes.

SALVIO GAMBIT.

WHITE. Mr. Gunsberg.	BLACK. Mr. Newnes.	WHITE. Mr. Harris.	BLACK. Mr. Mills.
1. P to K4	P to K4	2. P to KB4	P × P
3. Kt to KB3	P to KKt4	4. B to B4	P to Kt5
5. Kt to K5			

(This move does not lead to an advantageous line of play, as it gives Black the option of taking the attack in his own hands. The alternative to Kt to K5 is to play the Muzio Gambit by 5 Castling. The latter is preferable. A player who does not wish to undertake the difficult attack of the Muzio, must therefore either play 4. P to KR4, leading to the Allgaier or Kieseritzky Gambits, or not play the King's Gambit at all, but resort to the Bishop's Gambit by 3. B to B4, a very sound continuation.)

5. Q to R5 (ch) 6. K to B sq Kt to KR3.

(6. P to B6 leads to a very lively and attacking continuation known as the Cochrane Gambit.)

7. P to Q4 P to Q3.

(This move is not good at this point, because, as will be seen, the Kt is better posted on Q3 for defensive purposes. 7. P to B6 is Black's best.)

8. Kt to Q3 P to B6.

(Here 8. P to Kt6; 9. QB × P: Kt to Kt5, &c., may be played.)

9. P to KKt3 Q to R6 (ch).

(This is not good; it leads to very serious loss of time, for, with the White Kt on Q3 (note, to Black's 7th move), the Black Queen is lost if she plays to Kt7, nor can she stay at R6 on account of Kt to B4. Black's best move is to retire the Q to K2, instead of checking.)

10. K to B2.

(10. K to K sq. is most advisable.)

10. Q to Kt7 (ch)

11. K to K3 B to K2.

(Black will now be compelled to give up the Queen, for two pieces —Q to K7 (ch)—gives them a better chance of equalising the game.)

12. Kt to B4 B to Kt4.

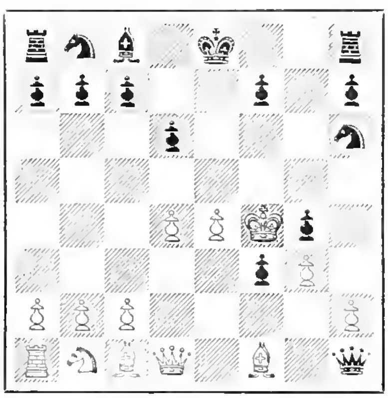
13. B to B sq B × Kt (ch) 14. K × B.

(P × B was the right move.)

14. Q × R.

(If Q to B7, then White plays B to K3.)

NEWNES. BLACK. MILLS.



GUNSBERG. WHITE. HARRIS.

15. B to Kt5 (ch) P to QB3 16. Q × Q P × B.

17. Kt to B3 Castles.

(By risking the P for a speedy development Black has everything to gain, and nothing to lose.)

18. Kt × P P to B4,

(continuing in the dashing style of his partner's previous move.)

19. P to K5.

(Unnecessary caution. White might have safely played 19 Kt to B7 if then P × P (ch). 20. K to K3, Kt to B4 (ch). 21. K to B2, Kt × QP. 22. Q to Q sq. winning.)

19. P × P (ch) 20. P × P Kt to B3

21. B to Q2 B to Q2 22. R to K sq. Kt to K2!

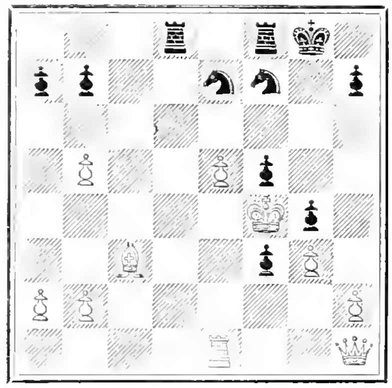
(Black's attack is speedily growing very embarrassing to White. If the latter now replies with Kt to B3 he shuts off his own B and Black would probably continue QR to K sq. Perhaps 23 Kt to Q6 was White's best.)

23. P to B4 B × Kt 24. P × B QR to Q sq!

(If White attempts to withdraw his K by K to K3 he will lose a piece, as Black would reply with P to B5 (ch)!)

25. B to B3 Kt to B2!

NEWNES. BLACK. MILLS.



GUNSBERG. WHITE. HARRIS.

(A fine idea! it would be too dangerous for White to stay with his K on B4 much longer. White cannot play R to Q sq. on account of Kt to Q4 (ch)! Or if 26. P to K6, Kt to Q4 (ch). 27. K × P to B7. (I do not see any other good move.) 28. P × Kt (ch), R × P (ch). 29. K × P, Kt to K6 (ch). 30. R × Kt, P to B8 (Q). 31. Q × Q, R × Q, and the game is equal. This is, I believe, the best result that White can attain. White can, of course, vary the proceedings at every move of this interesting position, but it may safely be assumed that the discovered checks in connection with the timely advance of the P to B7 would mostly win. Again, if 26. Q to B sq, P to B7. 27. R to B2 (best), Kt to Q4 (ch). 28. K × P, Kt × B. 29. P × Kt (best), Kt × P (ch). 30. K to K4 (best), Kt to B5, and Black will win. White can play 31. R × P, Kt to Q7 (ch). 32. R × Kt, QR to Ksq (ch), wins the Queen. A careful analytical examination of the position in this diagram will afford amusement as well as instruction.) 26. K to K3 Kt to Q4 (ch)

27. K to Q3 (best).

(If 27. K to Q2, Kt to Kt5 (ch), winning the exchange; or if 27. K to B2, Kt × B. 28. P × Kt. 29. R to Q7 (ch), K to Bsq, Kt to Kt4, with a won game.)

27. Kt to Kt4! 28. K to B2 Kt to K5

29. R to KBsq

(29. Q to Bsq seems better, but then Black could play R to Bsq with a strong game.)

29. Kt to K6 (ch) 30. K to Ktsq P to B7

31. P to K6 R to Bsq 32. P to KR3

I quote this game from memory some considerable time after it had been played. I cannot recollect the continuation from this point. Black won by Queening his Pawn at a later stage. But they might have won at once by Kt to Q7 (ch). 33 K to Rsq (if B × Kt then R × R (ch) wins), P to B8 (Q); and if 34. R × Q, Kt to B7 mate.

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