TRANSACTIONS
Kansas Academy of Science.

VOL. XIII.

1891-'92.

TRANSACTIONS

OF THE

TWENTY-FOURTH AND TWENTY-FIFTH ANNUAL MEETINGS

OF THE

KANSAS ACADEMY OF SCIENCE,

(1891–'92,)

WITH THE REPORTS OF THE SECRETARY.

VOL. XIII.

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THE TWENTY-FOURTH ANNUAL MEETING.

The Kansas Academy of Science met in its twenty-fourth annual session, at Ottawa, on October 14, 15, and 16, 1891.

From the minutes of the Secretary, the following notes are made:

The first evening was devoted to an address by President Robert Hay, on "The Great Plains."

A committee of three, consisting of Prof. F. H. Snow, A. H. Thompson, and D. S. Kelly, was appointed to frame resolutions on the death of Col. N. S. Goss.

The annual election of officers resulted in the choice of the following members for the offices named:

President — E. A. Popenoe.

First Vice President — F. O. Marvin.

Second Vice President — Mrs. N. S. Kedzie.

Secretary — E. H. S. Bailey.

Treasurer — D. S. Kelly.

Librarian — B. B. Smyth.

Curators — A. H. Thompson, B. B. Smyth, L. L. Dyche.

During the meeting, 16 names were proposed for membership.

On Thursday evening, a banquet was tendered the Academy by the Ottawa Science Club and citizens, at the Centennial hotel.

At the different sessions, the following papers, among others, were read.

PRESIDENT'S ADDRESS.

BY ROBERT HAY, JUNCTION CITY.

In some scientific bodies, a custom has grown up for the president of the year to give a summary of the progress of science, or of his own particular branch of science, up to that time. But it is also a custom that the president of any society shall in the address, that is perhaps his most onerous duty, do exactly as he pleases, and talk about whatever he likes.

In the position in which you have been pleased to place me, I shall honor this latter custom fully. I have first to say, then, though I have used the word "onerous" in respect to the duty now to be performed, that also I would use the word "honorable" to describe its relation to myself.

Ladies and gentlemen of the Kansas Academy of Science, I appreciate the honor you have done me. You give me this position as president of your sessions for 1891, and thereby you place me in the same chair that has been occupied by those men who have done most for the advancement of science in Kansas, who have thereby helped forward her fortunes, who have done something for her good name. I will not mention the names of my living predecessors in this honor, but will say that in occupying this position I feel the high dignity of being where was once my honored friend, our old associate and helper, president, and founder, Benjamin F. Mudge.

I will now, in conforming to the custom already mentioned, ask the attention of this audience to some account of the great region west of us. This is the Kansas Academy of Science. It might be called the "Great Plains Academy of Science." From North Dakota to Texas, there is no other society on the great plains that stands for the advancement of natural science. The only exception to this is that just recently a similar society has been born in Nebraska. The father of it is one of our own members, presidents, and founders, John D. Parker.

Recently a scientific man who lives in Texas, but whose reputation is national, expressed to me a strong feeling of envy because I lived in a State where an academy of science was possible.

Kansas, the central State of the American union, is one of the States of the plains. The *plains* comprise all the country from the east front of the Rocky Mountains to the 97th or 96th meridian, and from the Gulf of Mexico and the Rio Grande to beyond the northern boundary of the Dakotas and Montana. We might adopt a more eastern limit, but it is perhaps more convenient to call east of that line the Mississippi valley, though much of it, as here around Ottawa, is 1,000 feet above sea level, and several hundred feet above the waters of the great river. Be it so, then: what mostly we shall talk of to-night will be within the limits mentioned, and any remarks or conclusions that are applicable elsewhere may be so applied according to your own knowledge of localities.

Having for years been intensely interested in investigating the geology of the plains, it has seemed to me strange that this work did not receive as much attention as it might from famous geologists, who have passed over them to explore the geology of the mountains. I do n't think it strange any more; but, while I concede the fascination of the mountain studies, it still remains true that the region of the great plains is interesting in a high degree to every student of the outdoor sciences. Some of the points of interest I shall strive to bring before you, and, by the aid of the lantern, show you something of the scenery — its variety as well as its sameness — of the region of the great plains.

Before using the pictures, I wish to call attention to one or two of the physical features of the plains.

First, though gently rolling or apparently absolutely level for miles, yet there is a steady increment of elevation westward. The elevated land near Manhattan or Fort Riley is 200 to 400 feet above the Kaw river, and is 1,200 to 1,400 feet above sea level. At the State line, 300 miles further west, the elevation of the high prairie is 4,000 feet. At Cheyenne, in Wyoming, it is over 6,000 feet, and 20 miles west the plains abut on the mountains 1,000 feet higher. East and north of Colorado Springs the plains also reach the height of 7,000 feet, and there they do not abut against the mountains, but are cut off by well-defined valleys with a steep eastern escarpment.

Again, there is decrease of altitude of the plains north and south; north from the high lands of northern Nebraska, through the Dakotas, to the sea level of the Arctic ocean; south from the Llano Estacado to the Gulf of Mexico. Eastern Colorado and Wyoming have the highest land of the plains.

The plains are intersected by the greatest rivers of the continent. The Missouri, Yellowstone, Cheyenne, North and South Platte, the Arkansas, the Canadian and the Rio Grande are fed by the melting of the mountain snows, and carry great volumes of water, in shallow or deep, but broad and tortuous channels, across the plains to the sea.

But there are streams which are also large, but not as large as these, whose channels — whose source, course, and outlet — are on the plains; that is, there are mountain rivers and there are rivers of the plains. Into these latter no drop of mountain water is carried. In the region called semiarid they have their birth and take their course. Of these are the Red River of the North and the Red river of Texas, the Little Missouri, the Pecos, the White river of Nebraska, the Medicine river of Kansas, the Republican, Smoky, and Blue, the Running Water, and the Loup. These rivers have cut gashes in the plains and laid bare something of the geological structure. And besides this, they have varied the scenery — they have modified the climate.

Examination of these gashes shows us that the smoothest surface of the plains is caused by a fawn-colored subsoil, which we speak of as the plains marl. This is found on high land, and sometimes in valleys. It extends from the Rio Grande to the Mauvaises Terres of Dakota. It is a lake silt from 2 to 200 feet thick — a fertile soil to its lowest layer. Under this, and also where the plains marl does not cover it, is a formation of limy grit, sometimes white plaster, (the *terra blanca* of New Mexico, the native lime of west Kansas,) sometimes coarse mortar, sometimes a hard conglomerate or loose gravel, with little lime. It holds the water for all the wells of all the plains. None of this class of rivers, from Dakota to southern Texas, have permanent water in them till their channels have cut through this tertiary grit and found a bed on less permeable strata of the old formations.

In Texas there are some other surface deposits, and in the Dakotas the whole region east of the Missouri river has been overlain by a glacial drift, and long lines of boulders, ridges of gravel and shallow lakes testify to the presence of the ancient ice. These lake beds are silted up and are level meadows, and till and loess have made other parts level.

Under the surface formations, in nearly the whole region of the plains, the subjacent rocks are of mesozoic age. On the upper Missouri, at Fort Benton, and stretching down to southern Kansas, they are cretaceous (Laramie to Dakota and Trinity); further south the Trinity, again in the Canadian valley, and the red beds of the trias. Further east, even in Kansas, the surface tertiaries rest on rocks of carboniferous age.

Those who visit the grand cañon of the Colorado, usually learn the immense force of erosion. This lesson may be learned on the plains. All the valleys in which rivers run have been corraded by running water. The White river has cut the plains north of Pine Ridge down a thousand feet, and left the escarpment of that height a wall a hundred miles long. The Red river of Texas comes out of a ravine also a thousand feet deep, carved out of the Llano Estacado — a gash made by the agencies of nature, a wound gnawed by the tooth of time.

This erosion has been done since the surface formations were laid down, in the last tertiary or pleistocene lakes, but many of the valleys are on the lines of depressions made by erosion on the old cretaceous surface, which the later lakes filled up, and which the modern age has since reopened. This is true of the Kaw valley, and notably of those of the Smoky and Republican.

On the other hand, there are old valleys of the ancient premiocene erosion that have been filled up by the later submergences and not reopened. In western Nebraska there are large depressed areas without outlet for their drainage, except some underground percolation through sands and gravels that now fill up old river beds to the level of the highest prairies. In Kansas there are similar areas, the most notable being that which has its eastern terminus in the basin at Scott City, into which merges the valley of the White Woman Creek, 100 miles long. An underground channel probably allows water thence to percolate to the Arkansas, in the neighborhood of Garden City.

The mountains were uplifted after cretaceous beds were laid down in the great sea that covered all that is now western North America. The cretaceous and older strata are, on the flanks of the mountains, turned up on their edges, as at the Garden of the Gods. After this upturn, the tertiary lakes were formed and the surface formations of the plains deposited in them. There has been some uplift since, but the eroding forces have been at work on the plains as well as on the mountains, and some of the forms into which the mountains have been carved have been repeated on the plains. Fantastic carvings of arches, niches and temples are cut in miocene grit or cretaceous chalk. Monument rocks, mounds and promontories are cut by weather in Dakota sandstones, tertiary clays, or triassic red beds, and these forms in secluded valleys, near to or remote from railways, become places of resort; and the bracing air of the prairies, the skies as clear as those of Italy, the sea-like horizon, with the fertility of the prairie soils, all combine to assure us that the great plains shall be the abode of an abundant, healthy and intellectual population, which in the years to come will, perhaps, do some honor to us, as those who strove to implant, with the maize and the wheat, also the seeds of science and a love of truth on the great plains of America.

[Then followed an exhibit of the various kinds of scenery of the plains, from the moraines of North Dakota to the cañons of Texas, by transparencies in the stereopticon illumined by strong electric light, and manipulated by Professor Blake, of the State University.]

THE ORIGIN AND EVOLUTION OF THE HUMAN FACE.

BY A. H. THOMPSON, TOPEKA, KAS.

Of Evolution. It is not necessary at this late day, in the twilight of the nineteenth century, to defend evolution. To the truly scientific mind it has become a great working principle, like gravitation, and is no longer a theory or mere hypothesis, that is open to doubt and criticism. It rests secure upon the very pedestal of nature itself. The book of nature is the record of evolution. Every animal and plant carries in its structure the history of the origin and development of its species. The growth of an individual is an epitome of the evolution of the species. The development of an organ is the history of the origin and evolution of a function, or, indeed, of its decay, as when an organ dwindles to a rudiment from disuse.

Birth, growth, origin, development, genesis, evolution, inception, unfolding, are inseparable from the life history of every species, of every individual, of every organ, of every tissue, of every cell. As the individual has grown, so has the species. The principle of evolution applies to all and explains all. It is the working principle of biology, and to the scientific biologist requires no laudation nor explanation.

Prof. Joseph Le Conte says ("Evolution and Religious Thought") that "Every individual animal body has become what it now is by a gradual process. Commencing as a microscopic spherule of living but apparently unorganized protoplasm, it gradually added cell to cell, tissue to tissue, organ to organ, and function to function; thus becoming more and more complex in the mutual action of its correlated parts, as it passed successively through the stages of germ, egg, embryo, and infant, to maturity. This ascending series of genetically connected stages is called the embryonic or ontogenic series, the genesis of the individual." Again, he says: "Embryonic development is the type of evolution; and evolution is continuous, progressive change, according to certain laws and by means of resident forces. . . . Commencing with the lowest, unicelled, microscopic organism, and passing up the animal scale as it now exists, we find a series of forms similar to, though not identical with, the embryonic series. Here we again find cell added to cell, tissue to tissue, organ to organ, and function to function, the animal body becoming more and more complex in structure, in the mutual action of its correlated parts and the mutual action with the environments,' until we reach the highest complexity of structure and of internal and external relations only in the highest animals."

Of the Origin of Man. It is not yet possible to trace the descent of man back to the primeval protozoan, which was the origin of all life. His genealogy can only be approximated, and must forever remain a mystery. The process of the evolution of animal life does not form a continuous ladder from the lowest to the highest, for there are many breaks and missing links. The protozoan is the lowest sub-kingdom, the vertebrate is the highest, but the line of ascent from the one to the other is not homogeneous, nor continuous, nor symmetrical.

Man is a vertebrate animal, but the course of his descent, even after the differentiation of the mammalia from the vertebrate series, is very uncertain. He retains morphological affinities with so many and sometimes widely separate branches, that he is not related so very closely to any of them. He most resembles the anthropoid apes, of course, but it is only by parallel — not direct — descent that he is related to them. He is not descended from them, but from a common ancestral form with them, which, in its turn, was descended from a common progenitor of other vertebrates. When the genealogy of man shall have been worked out as completely as that of the horse, for instance, we shall have a wonderful biological history, but for the present that history is incomplete. Darwin says ("Descent of Man"): "The most ancient progenitors in the kingdom of the vertebrata probably consisted of a group of marine animals resembling the larvæ of existing ascidians. These animals probably gave rise to a group of fishes as lowly organized as the lancelet, and from these the ganoids and others, like the lepidosiren, must have been developed. From such a fish would arise the amphibians — the fish-like reptiles — and from these the true reptiles and birds. These are closely connected with the monotremata, which connect mammals and reptiles in a degree; but the line of descent of the higher vertebrate classes — mammals, birds, reptiles — from the lower classes — amphibians, fishes, etc. — is obscure. But from the monotremata arose the marsupials, which were the early progenitors of the placental mammals. We may thence ascend to the lemuridæ, and thence the interval is not very wide to the simiadæ. The simiadæ then branched into two great stems — the new-world and the old-world monkeys — and from the latter, at a remote period, man proceeded." Not from the forms that now exist, however, but from a common progenitor with them. Our study of the face will, therefore, need to be comparative, perhaps, more than genealogical, except in the few instances in which there is evident descent. There are gradation stages plainly evident, as the facial parts arose from the lower, headless forms of animals, which possessed neither face nor separate sense organs.

Of the Special-Sense Organs and the Origin of the Face from Them. The mere structures of the face arose from its parts having been evolved and erected for the accommodation of some of the special-sense organs. In fact, we must place its origin at the time of the differentiation of the special senses, when special structures were demanded for their support and protection. We follow backward along the path of the evolution of the face, and find its origin in the differentiation of the four facial senses. But, previous to this differentiation of sensation into the various special senses, we observe that unspecialized nervous organization preceded function, unless, indeed, sensation exists without and preceded nervous organization.

"It is well known that the protozoans—sponges, cœlenterates, infusoria, etc.—depend for sensation and motion upon the irritability and contractability of protoplasm," says Mr. A. S. Packard ("Standard Natural History"). Again: "A genuine nervous organization for the first time appears in the jelly fishes. The echinoderms, starfish, etc., have a mere nervous ring, but probably without ganglia: but in all other invertebrate animals, from the worms and mollusca to the crustaceans and insects, the nervous system consists generally of a pair of ganglia above the esophagus, called the brain, on the under side a second pair, and the four ganglia, with the nerves and commissures connecting them, is often called the esophageal ring, from which slender threads reach away to the various parts of the body. In some forms the lower pair of ganglia are missing, and others have another pair, the visceral ganglia, added. In the higher worms, crustacea, and insects, there is a chain of ganglia or brains which are ventral, and line the floor of the body cavity. In the very highest invertebrates there is a mass of ganglia, as in the head of the cephalopods. In the vertebrates the brain is more simple, consisting of a series of close-set ganglia, forming a mass situated in a bony case, the skull, with the spinal cord extending through the vertebræ and having a definite relation to the sense organs, and sending branches to all parts of the body.

"The tactile sense, or sense of touch, is common to all animals. It is the fundamental sense, of which all others are but modifications. The most conspicuous sense organs are the eyes. A transparent spot on the front of some lower forms is probably the simplest of all sense organs, and anticipates the eye of higher animals. The simplest form of eyes is perhaps those of the sea anemone, in which there are, besides pigment cells, refractive bodies, and from this true eyes develop as the scale of life advances. In some worms true eyes appear—a projecting, spherical lens, behind a vitreous body, retina, and optic nerve. In the crustaceans, the eyes assume a quite definite place in the head, except in a few instances. In insects the eyes, both simple and compound, are located definitely on the head. In the skulled vertebrates, the eyes are of definite number, and in all types occupy a definite position in the head.

"The simplest kind of auditory organ is found in the jelly fishes, the first lower form in which it appears. The otocysts, or simple ears, of the worms and mollusks are minute and usually difficult to find, as is the auditory nerve leading to the nerve centers. In the clams the ears are in the so-called foot; in the cuttle-fish and snails, in the head close to the brain; in the shrimps and crabs, at the base of the mandibles; in a few other crustaceans, at the base of the tail. In the insects there is a real tympanum cavity—a sac with a ganglionic cell within, but the position is very variable. In the locusts, the ears are at the base of the abdomen; in the katydids and crickets, in the fore tibia; in the butterflies, probably in the antennæ, etc. In the vertebrata the ears are two in number, and are definitely situated on the sides of the head. The sense of smell is obscurely indicated by special sense organs in the invertebrate animals, nasal organs, as such, being characteristic only of the skulled vertebrates. The organ of taste seems to be specially differentiated only in the vertebrates, so far as we can tell."

Our field is thus reduced to the vertebrates, for the sense organs are so scattered throughout the body in the invertebrates that there is really no such part as the face in that class, as understood when speaking of the vertebrates. It is in this latter class only that this part becomes apparent as the seat of four of the special senses. How, then, does the face originate and develop in the vertebrata?

In the vertebrates (Mr. Wright, *op. cit.*), "all the higher sense organs may be regarded as differentiated parts of the skin, the nerves of which have become greatly specialized, and have thus acquired a more marked individuality than the other sensory nerves. . . . Regarding the auditory organs, in the fishes only the internal ear is present, without the additional drum cavity and external ear which we find in the higher forms. In the sharks the auditory labyrinth is surrounded by cartilage, but in most fishes it is free. . . . The higher vertebrates carry out the plan begun in the sharks, the labyrinth being completely protected by an osseous capsule." Audition is assisted in some of the higher forms by the erection of a sort of sounding-board from the integument — the external ear. This becomes a very expressive feature in some forms, as in *Equus*.

"The eye is rather more elaborated regarding its internal structure in the higher vertebrates," and its position in the face is such as to make it a very important adjunct in expression. It is considered to convey as much expression as the facial features, and becomes expressive at an earlier stage in the evolution of the face. That is, animals which have little or no facial expression, whose features are undeveloped and immobile, have eyes which are very expressive, and indicate the feelings and passions with no uncertain signs. Its supporting structures have little influence in modifying the features, as they are not extensive in the class.

The olfactory sense organ is more important, regarding the influence it has in modifying the facial contour of animals. The structures erected for its accommodation present great variety, and are often very extensive. The organ of smell "first appears as an involution of the skin in the lowest forms, and in *Amphioxus* is represented by a ciliated sac near the anterior opening of the neural canal," and retains this relative position in all vertebrates. "In fishes the forms of this organ are very various, but in the sharks a groove leads to the roof of the mouth, which is afterward changed into a canal in other higher forms." From this beginning the organ is developed in various forms, and in some animals, as the ruminants, an extremely extensive structure is erected, with long and high nasal bones and large turbinated bones, for its accommodation.

How much the sense of taste has had to do with the development of the tongue, and consequent effect upon the oral structures, we can form no estimate, for these structures seem to be erected mainly for the accommodation of the dental armature. The jaws vary as the food habits cause the teeth to vary, or as the teeth may be developed for other purposes. As these are modified to adapt them to the food habits, the jaws are formed to support the teeth, as, for instance, in the carnivora or the ruminants. The mouth is developed, from a mere orifice for the reception of food for its introduction into the alimentary canal, to the position of an important facial feature. In the higher forms the lips advance from mere prehensile organs to becoming conspicuous features in facial expression, for in man the mouth is the most expressive of the mobile features.

Regarding the face in general, in the lowest vertebrates (Mr. Wright, *op. cit.*) — the tunicates, acrania, etc., those headless vertebrates which are scarcely differentiated from the mollusca and were long classed with them — there seems to be little or no provision for the special senses, and, of course, no trace of a face. In the lampreys occurs the first indication of a skull, and two eyes are present, the proper vertebrate number. The sharks have the eye and ear organized much like the higher vertebrates. The mouth is placed back of the tip of the snout, and in this class the lower jaw begins to assume the form of the higher vertebrates. Throughout the class of fishes there is little to be learned as to the face. The skull is well developed, the eyes are large and expressionless, and the mouth is moved forward to the end of the snout. In the eels the face has advanced a little, and is nearer the reptile form. Many curious forms of fishes have remarkable, often grotesque, facial forms and expressions — if such low faces can be said to have expression. Comparative physiognomy could liken them to many curious human physiognomies to which they bear resemblance.

In the batrachians, intermediate between fishes and reptiles, we find similar expressionless faces, and but little further elaboration for the accommodation of the sense organs. Being amphibious, however, there begin to be some special structures for nasal breathing. The prominent eyes of the toads and frogs are conspicuous features. The mouth is still a mere slit in the integument for the admission of food, and the outer ear does not yet appear.

In the snakes, the face is still an expressionless area of the integument, but the cruel eyes display the vicious passions. Any variation of expression in the ophidia is in the degree of the vindictive emotions—they live to kill. In the lizards begins the first suggestion of expression of the better emotions, for they really have a benign, or at least innocent, face in some species. Other reptiles are grotesque or vicious or expressionless, the face being a mere mask of scale mail, as in the crocodiles. In the birds, modified from the reptilian ancestors from which they are descended in common with contemporaneous reptiles, there is little facial expression, but, as a class, they convey all variations of the emotions through the eyes, which are very eloquent. The nasal structures have considerable development, in some forms, and the extensive jaws are covered with horny sheaths called "the bills," or mandibles, which are varied infinitely to accommodate them to various foods and other purposes.

In the lower mammals, there is not much advancement, in the shape of the face and the structure of the sense organs, from the reptiles. The outer ear appears, and adds to the expression of the face in various ways. The nasal structures are extended, the mouth widens, and the lips appear. In the rodents, the face is shortened and the lips are elongated. The elephants have considerable elevation of the forehead, which gives them the appearance of the intelligent character which they possess, although this elevation is not due to brain, but to bone and air cells. The other pachyderms have flat and expressionless faces, there often being extravagant elongation and enlargement of the mouth. The horns on the nose of the rhinoceros do not add to his beauty, and the face of the hippopotamus is not to be coveted! The face of the horse seems much distorted by the great elongation of the oral and nasal structures, but the ears are the most expressive features in this genus. In the ruminantiæ—especially the deer family—the face is elongated for the accommodation of the extensive nasal sense organ and the masticating area. Perhaps the sense of taste is more developed in the animals that have larger tongues, for discrimination in regard to foods, but of this we have no knowledge. The eye is large, beautiful and expressive in this class.

In the carnivora, we find the face shortened below and widened above, to accommodate the peculiar jaws, which are short and strong, for tearing flesh. In accordance with the habits of the class, the face is often cruel and vicious, and becomes ferocious and terrifying when the destructive passions are aroused. We first meet here some expression in the features, for the mouth and lips, eyes and ears, can be made to express affection, fear, defiance, anger, etc., as in the cat and dog.

In the primates, we expect to find the closest approach to man, for, in the process of collateral development from a common ancestry with them, man has retained many of their peculiarities. We can follow the evolution of the face pretty closely by studying it in this class from the lowest to the highest forms. In the lowest of the primates, the lemurs, there is little change from the carnivorous mammals. The face is covered with hair, and devoid of expression. The ears are large, but have become more or less motionless; the eyes are expressive; the nasal and oral parts are reduced, but the face is still that of the mammals. The lower incisors are usually inclined forward, are not vertical, so there is no chin.

Advancing to the monkeys proper, we find a sudden change. The face becomes at once the seat of expression, and even the little marmosets have considerable facial expression. The face is more or less bare, and the features become mobile, the eyebrows and lips being very active. But the nose is ill-developed, embryonic, in fact, and is especially deformed in the new-world monkeys, in which the nostrils are set wide apart and look outward — not close set and looking downward, as in the old-world monkeys. The upper lip is wide and stiff; the mouth begins to have some expression, but the chin is still absent. The mouth has a characteristic upward curve at the center, and dips downward at the corners — a quadrumanous characteristic which reappears in many coarse human mouths, as many quadrumanous peculiarities do thus reappear in the face of man. Various parts of the faces of monkeys may be covered with whiskers of various colors, especially the lower part of the face and chin.

The baboons have a long, dog-like face, the nose, mouth and chin resembling the canidæ. In some forms, as the drills and mandrills, the face is peculiarly marked by highly-colored skin. The remarkable cheek pouches, which are used for carrying food, are a characteristic of many of the baboons.

The Anthropomorpha comprise the man-like apes — the orang-outang, the chimpanzee, and the gorilla, as these, taken together, approach man most nearly in general structure. One species resembles him in one part and another in a different part. None of them are very close, of course; but it has been often remarked that there is less difference than between the highest apes and the lowest quadrumana, the lemurs. The lowest savage differs from the highest civilized man almost as much as he does from the apes.

In the orang the forehead is full and rounded, and the face less brutal and ferocious than in the gorilla. The head is pointed and high, and the shape of the brain more like that of man than that of any of the other apes. The lips are long, full, projecting, and expressive. Their forms are recalled by the negroid and Celtic races of man, and perhaps others.

The troglodytes include the chimpanzee and gorilla. The latter has strong and high supra-orbital ridges, erected for the attachment of enormous muscles, which give him a ferocious and forbidding appearance. The ridges reduce the apparent height of the brain case also. In the chimpanzee the whole face is more like that of man, the ridges being reduced and the face less brutal than in the gorilla. The head is not so pointed as that of the orang, but higher than that of the gorilla. The flat condition of the external nares gives the chimpanzee's face an immature look. In the young the face is almost human, but the supra-orbital ridges and retreating forehead grow and increase with age, bringing out the animality. The ears are more like those of man, and the lips are neither so extensile nor so large as in the gorilla and orang. The face in the apes is bare, brown skinned, and much wrinkled.

Professor Mivart (in "Man and Apes") is uncompromisingly opposed to the theory of the descent of man from an ape-like ancestor. He delights especially in debasing the much-vaunted gorilla as the near relative of man, and seeks out resemblances in other primates that bring them just as near, or nearer, to man. But these also prove the position of the evolutionist and the defender of the hypothesis of the common origin of man and the quadrumana; for it is the resemblances in the class in general, and not in any one species, that he would look for. Professor Mivart says: "The gibbons are more human than the orang, the chimpanzee, or gorilla, as to the preponderance of the brain case over the bony face. But the smaller American monkeys exceed the gibbons in this respect, while the squirrel monkey exceeds man himself. A striking feature of the human skull is the prominence of the inferior margin of the lower jaw in front — *i. e.*, the presence of the 'chin.' This feature is quite wanting in even the highest anthropoidæ. A more or less developed chin exists, however, in some lower forms, as the siamang, although no other ape or lemur shows a similar condition. Another marked human cranial character is the projection and transverse convexity of the bones of the nose. This convexity is quite absent in the chimpanzee and in most gibbons. In the orang these bones are exceedingly small and flat, often even uniting into one bone or with the adjoining jawbones, if indeed they are not altogether absent. In the gorilla they are slightly convex transversely at their upper part, so that here we seem to have evidence of the predominant affinity of the gorilla to man. Further examination, however, shows that this character can have no such meaning, since a still more decided convexity is found to exist in some Semnopitheci, and even in the lowest baboons. In the latter the nasal bones only become more convex toward maturity, being at first flat. . . . Now it is not the chimpanzee, certainly not the gorilla, nor yet the gibbon, which most resembles man as regards his brain. In this respect the orang stands highest in rank. The height of the orang's cerebrum in front is greater in proportion than either the chimpanzee or gorilla, while the brain of the latter is below that of the chimpanzee; so that this much-lauded ape is inferior to both the orang and the chimpanzee. The simian's faith is at fault, and the pretender gorilla must abdicate in favor of two better claimants at least."

Professor Huxley says ("Man's Place in Nature"): "In the gorilla the face, formed largely by the massive jawbones, predominates over the brain case: in man the proportions of the two are reversed. In man the surface of the skull is smooth, and the superciliary ridges or other prominences usually project but little, while in the gorilla vast crests are developed upon the skull, and two strong ridges overhang the cavernous orbits like great penthouses. Sections of skulls show, however, that some of the apparent defects of the gorilla's cranium arise in fact not so much from deficiency of brain case as from excessive development of parts of the face. The cranial cavity is not ill shaped, and the forehead is not truly flattened or very retreating, its really well-formed curve being simply disguised by the mass of bone which is built up against it. . . . It is the large proportional size of the facial bones and the great projection of the jaws which gives the gorilla's skull its small facial angle and the face its brutal character. . . . The lower apes and monkeys exaggerate the general proportions of the muzzle of the great anthropoid, so that his visage looks mild and human by comparison with theirs. The difference between the gorilla and the baboon is even greater than it appears at first sight, for the great facial mass of the former is largely due to a downward development of the jaws; a certain human character, superadded upon that almost purely forward, essentially brutal, development of the same parts which characterizes the baboon, and yet more distinguishes the lemur. . . . The orang's skull is as devoid of excessively developed superciliary prominences as man's, though sometimes exhibiting crests in other places. In some of the cebine apes or others the cranium is as smooth and rounded as that of man himself."

The truth is that the divergencies are so many and the resemblances so few that none of the anthropomorpha are really very near to man. Still, the class, taken together, presents many indications of relationship. In the facial form and features there are many such resemblances, evidencing the collateral development as well as the relationship of the face in man and the quadrumana.

The human face, like the remainder of the mere tenement of the soul, came up through many vicissitudes to its present beauty and perfection. As Huxley again says (*op. cit.*): "Our evidences of the nobility of manhood will not be lessened by the knowledge that man is, in substance and structure, one with the brutes; for he alone possesses the marvelous endowment of intelligence and articulate speech, whereby, in the secular period of his existence, he has clearly accumulated and organized the experience which is usually lost in other animals." The face indeed has developed from the highest plane of animal life to that highest plane of human life, where we find its perfection, along with the development of that higher intellectual power which dictated its superior formation. The path by which the mutual and simultaneous development of the face and mind was accomplished after the mere brute was left behind is entirely lost; but we know by the wonderful results that there was such a growth, sometime, somewhere. The face and brain were developed collaterally, and the high perfection of the face in man is due to his high brain development. It is unfortunate that the paleontological history of man has not been recovered; but when it is found, this, among other important questions, will receive a flood of light. For the present, we must be content with studying the evidences of the evolution of the face in the collateral animal branches and in the embryological record.

We turn next to the record of *embryology*, which is, in many respects, much more clear and continuous in the genetic evolution of the face than the comparative record. The latter is sadly mutilated and broken, so that only in a very few instances, as in the case of the horse, can the history of the development of a species be made out at all. Contemporaneous species give us an analogical history only, but we can judge from them what the evolutionary history of man must have been like. That far we are positive, however, for the assumption is borne out by the history of the few species in which the record is complete, and we must reason from analogy that those whose record is incomplete must have had a similar history of evolution and development. Man is, unfortunately, one of the species in which the record is most incomplete; but judging from analogy, we necessarily infer that he must have had a similar process of evolution. From this induction there is no escape.

The Mind of Man. But to his animal organization there is superadded the conspicuous peculiarity of a high intellectual growth which is absolutely unique, and which sets him apart in a great department of his own. No other animal approaches him in regard to mass of brain or mental power. The history of the development of this remarkable faculty is entirely lost, for we are as yet in total ignorance of the barest hint of the process by which it arose. We are not convinced that it could have been developed from an ordinary animal intelligence, for the mind of man has many qualities which set it apart and distinct from the animal mind. It is these qualities of mind and the victories over nature, and great achievements by reason of these qualities, which distinguish man from the mere animal. It does not seem possible that they could have been developed from the animal mind, so far as we know the latter by its phenomena; but as we know it *only* by its phenomena and cannot become *en rapport* with it, we cannot judge finally. We may yet be permitted to accept the final cause of a supernatural interference in the process of the creation of the human mind as a distinct and peculiar endowment of our species, which cannot be accounted for by the natural processes with which we are acquainted.

Be the source what it may, the human mind is a powerful factor in influencing the evolution of the face, and to this is due the high development of that area of the human body as an expressional organ. The influence of the mind upon the face in the individual is, however, mainly postnatal; for whatever this may be in utero is probably only hereditary, with, perhaps, some occasional effect from transient maternal emotion. Without stopping to dwell upon this, we pass now to the study of the evolution of the face from the embryological aspect, in addition to its anatomical history from the comparative standpoint. This will lead us to a better understanding of the unfoldings and unfoldings, through past germinal forms, through which the human face has come, up to the perfect flower of to-day.

We notice at the outset that the subject of the *embryological history of man is greatly misapprehended*, although, as we have noticed before, it is simple in its principles, when studied from the evolutionary and comparative standpoint. We have been a long time in accepting the self-evident fact that the human embryo passes through stages of evolution that recall and illustrate the growth of the species; for the growth of the embryo is, in fact, an epitome, a panorama in miniature, of the growth of the species. It presents, at various and successive steps, conditions and parts which are permanent in lower animals. At first it resembles the very lowest forms, then those next higher, then those still higher, and then again higher, until its own type is reached, when its form, in turn, becomes permanent. Its growth simply illustrates the growth of the species, and, by graded stages of resemblances, points out the path by which its own type was reached in the evolution of the species. But simple as this fact is, it remained unrecognized for long years, and is, indeed, understood by but few intelligent people even now. Prof. Ernst Haeckel, in "Evolution of Man," writes at length of "Anthropogeny," as the evolution of man is christened. "It is surprising," he says, "to see what a little way the knowledge of human evolution has spread, even among the very students of nature." Or again ("History of Creation"): "The facts of embryology would alone be sufficient to solve the question of man's position in nature, which is the highest of all problems, for their philosophical importance cannot be too highly estimated. He proceeds to explain this important branch of science, and begins:

"Our first principle of biogeny is, the evolution of the germ is a condensed evolution of the tribe, and the reproduction is more complete in proportion as, in consequence of constant heredity, the original inherited evolution is more closely realized."

Haeckel again says ("Evolution of Man"): "At a certain period in the development of the human embryo it has essentially the anatomical structure of a lancelet, later of a fish, and, in subsequent stages, of amphibian and mammal forms; in the further evolution of these mammal forms, those first appear which stood lowest in the series, such as the forms allied to the beaked animals (*ornithorhynchus*); then those allied to the pouched animals (*marsupialia*), which are followed by forms most resembling apes, till at last the peculiar human form is produced as the final result."

The *embryology of the face* is not difficult to follow. It is conceded that its main elements are formed from the remains of the gill arches of the fishes and early vertebrate amphibious forms. In the early embryonic condition of the higher vertebrates, including man himself, we find on each side of the neck several gill slits, each with its gill arch. Mr. R. R. Wright ("Standard Natural History") says: "In the aquatic vertebrates the anterior part of the alimentary canal communicates with the outside by a series of gill clefts on either side, through which the water streams for respiratory purposes. Although these gill clefts shortly disapper, with the exception of the first, in the air-breathing vertebrates, yet they are present in the embryos of all, even of the highest. Between the clefts (also known as the visceral clefts) are solid pillars, visceral folds, which are not developed in the higher forms, except in the first and second arches, the rest being suppressed or nearly so. An actual fusion takes place between the upper arch and the cranial skeleton to form the upper jaw, while the second arch is modified into the lower jaw, the Meckelian part, which is hinged to the upper jaw and suspended from it." From this orgin the jaws are developed in all the higher forms, man included. In the human embryo the origin of the face and jaws is well indicated, the gill clefts being quite conspicuous in the embryo face. Their failure to unite is the cause of that embryological deformity known as harelip.

Of the origin of the vertebrate mouth, Mr. Bettany writes (following Doctor Dohrn, "Nature,") that "the vertebrate mouth is a modern structure, and arises extraordinarily late in development. The embryonic body is almost completely formed, all the great systems are established, while as yet there is no mouth. It does not arise either in the position in which it permanently remains in the majority of vertebrates, but undergoes considerable shifting. Only in some fishes does it retain its primitive situation. The study of its development establishes the idea that the mouth of vertebrates is homologous with the gill clefts."

Haeckel, in "History of Creation," again says: "In all craniota, that is, all vertebrate animals having a skull and brain, the brain, which is at first only the bladder-shaped dilations of the spinal marrow, divides into five bladders, lying one behind the other. This is just the same in all vertebrate embryos, from the lowest to the highest. The whole form of the body is as yet exceedingly simple, being merely a thin, leaf-like disk. Face, legs, intestines, etc., are completely wanting, but the five bladders are quite distinct. The *first* bladder, the fore brain, develops into the hemispheres of the large brain, the cerebrum. The *second* forms the center of sight," etc. . . . "An exceedingly important formation, of which we are not able to recognize a trace in the full-grown animal, are the *gill arches*, which originally are common to all vertebrate animals, but which at a later period are transformed into the most different organs. Everyone knows the gill arches of fish — those arched bones which lie behind one another to the number of three or four, on each side of the neck, and which support the gills, the respiratory organs of the fish. Now, these gill arches originally exist in embryo exactly the same in man, in dogs, in fowls, in tortoises, as well as in other vertebrate animals. It is only in fishes that these remain in their original form and develop into respiratory organs. In the other vertebrate animals they are partly employed in the formation of the face (especially the jaw apparatus) and partly in the formation of the organ of hearing.

"An examination of the human embryo in the third or fourth week of its existence shows it to be altogether different from the fully-developed man, and that it exactly corresponds to the undeveloped embryo form presented by the ape, dog, rabbit, or other mammals at the same stage of their ontogeny. At this stage it is a bean-shaped body of very simple structure, with a tail behind and two pairs of paddles, resembling the fins of a fish. Nearly the whole of the front half of the body consists of a shapeless bud without a face, on the sides of which are several gill fissures and gill arches, as in fishes. . . . In the embryo of man, as in all other vertebrates, the very remarkable and important structures which are called the gill arches and gill openings appear at a very early period, on each side of the head. These are among the characteristic and never-failing organs of vertebrates. . . . The number of these gill arches and of the gill openings between amounts, in the higher vertebrates, to four or five on each side; but the lower forms have a yet larger number. Originally they are used for respiration. In the higher vertebrates they afterwards close, and are transformed partly into the jaws and partly into the bonelets of the ear. Almost simultaneously with development of the gill arches, and immediately behind these, the heart, with its four compartments, is formed, and above, on the side of the head, the rudiments of the higher sense organs appear — the nose, eye, and ear. These highly important organs originate in the very simplest forms. The organ of smell appears quite in front of the head, in the shape of two little pits, above the mouth opening. The organ of sight, also in the form of a pit, comes next behind the organ of smell, toward which a considerable vesicular outgrowth of the fore brain grows on both sides of the head. Farther back appears a third slit on each side of the head, the first rudiment of the organ of hearing."

Or again: "At a very early stage, and while no trace of the characteristic facial structure of man is yet visible, a pair of small grooves appear before the primitive mouth cavity, the primitive nasal grooves. They are separate from the mouth cavity, which also makes it appearance as a groove-like indentation of the external skin, opening in front of the blind anterior extremity of the intestinal canal. This pair of nasal grooves, as well as the single mouth groove, are lined by the external epidermis. The two inner nasal processes or flaps arise right and left of the grooves, and opposite to these rises another groove, between the eye and nasal grooves. A plug-shaped formation projects into the nasal grooves, which is the upper-jaw process. Below the mouth groove lie the gill arches. The first of these develops into the jaw skeleton of the mouth, and is called the jaw arch. A small process first grows out from the base of the first gill arch; this is the upper-jaw process, which forms the principal part of the framework of the upper jaw. On its outer side the bone afterward unites, and in the middle portion the intermaxillary develops for the anterior portion of the frontal process. . . . The external nose is not developed until long after all the internal parts of the sense organ have been formed. It appears at the end of the second month, and grows out to form the process, but the form characteristic of man does not appear until a far later period. In most forms, the nose retains an undeveloped form. . . . The outer protective parts of the eye are merely simple folds of the skin, which appear in the third month. The inner parts originate from the inner structures of the head. . . . The entrance to the intestinal canal is the mouth opening, which is part of the intestinal system, and receives the food, which it passes on to the digestive organs. The external opening originates in a fold or groove-like incision of the external skin, and its membrane is formed from the skin. . . . The original formation of the mouth skeleton, the upper and lower jaws, is traceable to the gill arches."

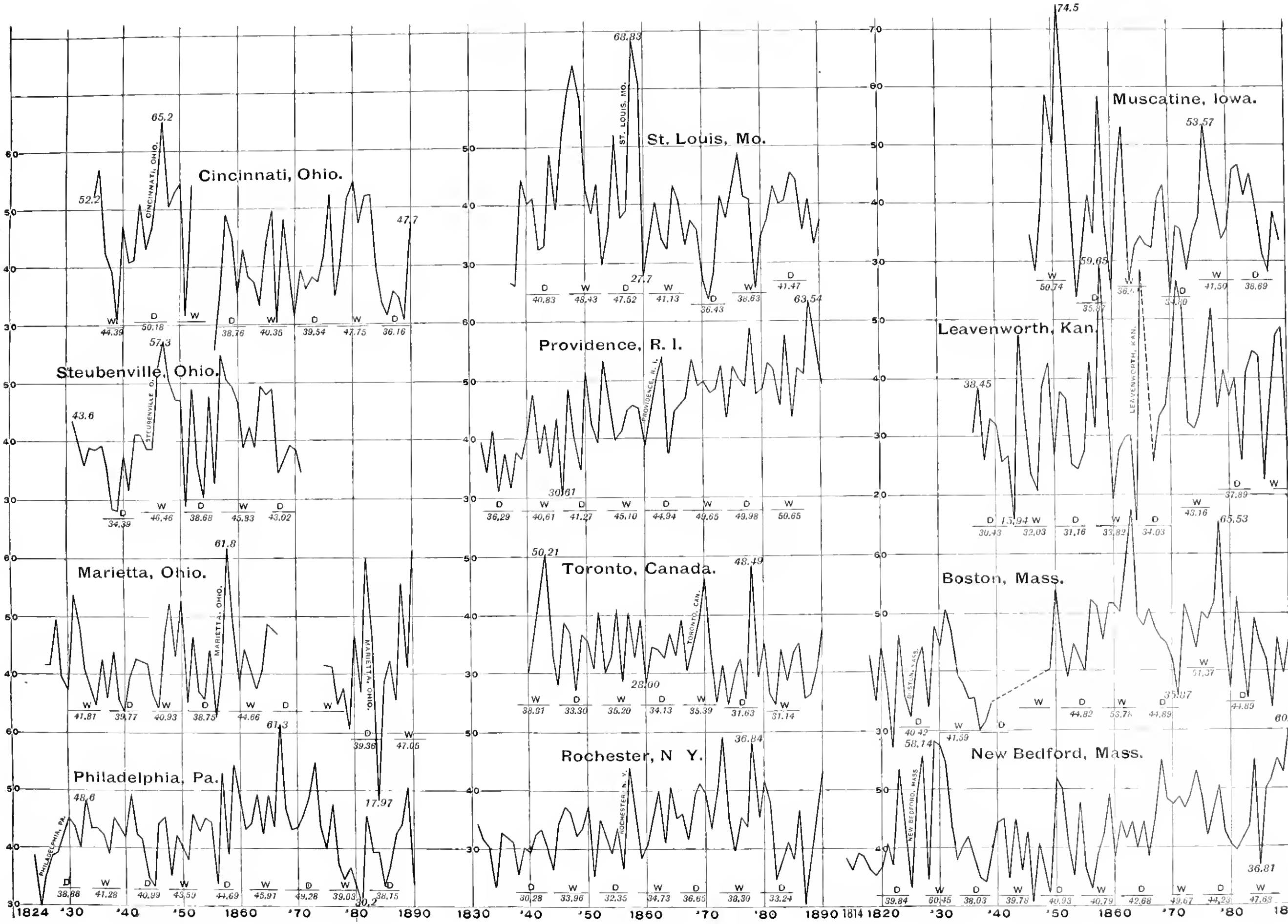
From these remarkable beginnings there has been developed the human face, with all its superadded powers of expression and physical beauty. The first crude and immature form, as seen at birth, with all its future possibilities, is produced by evolution along the same path which leads to the development of the same parts in other animals, as already noted. The resemblance to lower forms is maintained to the last stage, the last animal resemblance to disappear in the face of the human embryo being that of the apes.

We have now studied the origin and followed the evolution of the face by various paths. Surely the little evidence we have here gleaned from the great field of nature is of itself convincing that the face of man has arrived at its present perfection not by accident, not by one stroke of creative power, but by the simple, philosophical and natural methods of gradual development and evolution, in accordance with nature's laws.

IS THE RAINFALL IN KANSAS INCREASING?

BY E. C. MURPHY, LAWRENCE.

This important and interesting question is one which has been much discussed. The writer's reason for undertaking its discussion at this time is his belief that his division of the record into periods and his treatment of the means of these periods is different from that of other writers, and answers the question asked in the title as



Cincinnati, Ohio.
Steubenville, Ohio.
Marietta, Ohio.
Philadelphia, Pa.
St. Louis, Mo.
Providence, R. I.
Toronto, Canada.
Rochester, N Y.
Muscatine, Iowa.
Leavenworth, Kan.
Boston, Mass.
New Bedford, Mass.
1824
'30
'40
'50
1860
'70
'80
1890
1830
'40
'50
1860
'70
'80
1890
1814
1820
'30
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1860
'70
'80
1890

conclusively as it can be answered from the record. He does not claim to be the first to show that the rainfall in Kansas is increasing, or to note the fact of periodicity in rainfall. Prof. F. H. Snow and others have noted these facts.

The following table of annual rainfall of places in Kansas, taken mainly from the Fifth Biennial Report of the Kansas State Board of Agriculture, is the data that I have used. The rainfall for 1891 is computed from the observed rainfall for the first eight months and the mean monthly rainfall for the remaining four months:

TABLE NO. 1.

Year.	*Ft. Leavenworth.*	*Manhattan.*	*Lawrence.*	*Ft. Scott.*	*Fort Larned.*	*Topeka (Washb'n College).*	*Dodge City.*	*Wellington.*	*Wallace.*
1836	*30.66								
1837	38.45								
1838	26.28								
1839	33.32								
1840	32.14								
1841	*25.90								
1842	*26.29								
1843	15.94			44.65					
1844	48.12			62.60					
1845	34.56			61.59					
1846	23.75			34.04					
1847	21.03			34.36					
1848	37.99			29.25					
1849	42.85			45.43					
1850	27.07			30.03					
1851	37.81			33.01					
1852	36.53			46.52					
1853	25.20								
1854	24.40	16.95							
1855	27.55	25.25							
1856	42.72	24.84							
1857	31.71	17.98							
1858	59.65	31.97							
1859	38.84	36.17							
1860	19.38	14.72							
1861	27.27	35.35							
1862	29.50	27.80							
1863	*30.40	40.54							
1864	*15.93	20.08							
1865	*50.88	34.23			36.50				
1866		23.73							
1867	*25.72	26.50			18.35				
1868	33.18	30.08	37.48		24.70				
1869	35.31	28.22	38.51		14.11				
1870	43.18	21.19	31.32						
1871	56.75	28.62	33.23		13.64				
1872	51.61	35.78	32.63		12.97				
1873	32.16	26.16	32.94		18.23				
1874	33.81	17.61	28.87		21.73				
1875	31.26	17.96	28.87		17.80		10.69		15.85
1876	44.48	46.43	44.18		18.19		15.40		16.98
1877	52.05	43.79	41.09		30.18		27.89		16.61
1878	35.15	39.10	38.39				17.96		19.28
1879	41.55	36.86	32.68			33.14	15.43	28.96,	16.56
1880	36.86	29.11	32.65			32.77	18.12	19.70	34.10
1881	39.95	28.94	35.27			26.33	33.55	39.47	8.38
1882	25.97	28.35	27.60			25.22	13.14	36.10	
1883	41.04	36.79	46.65			44.43	28.50	40.49	
1884	44.72	33.62	43.70			42.62	30.36		
1885	43.70	25.09	36.97			30.35	27.76		
1886	22.45	27.25	24.25			23.23	15.14		
1887	37.05	29.34	33.84						
1888	42.21	31.23	44.17						
1889	40.93	33.76	43.99						
1890	28.49	24.99	36.32						
1891	46.07	35.90	46.49						

* Figures obtained by interpolation.

The records of Fort Leavenworth, Manhattan and Lawrence are the only ones extending over a period of sufficient length to be of much value in answering this question.

The accompanying chart shows the annual rainfall line drawn to scale for these

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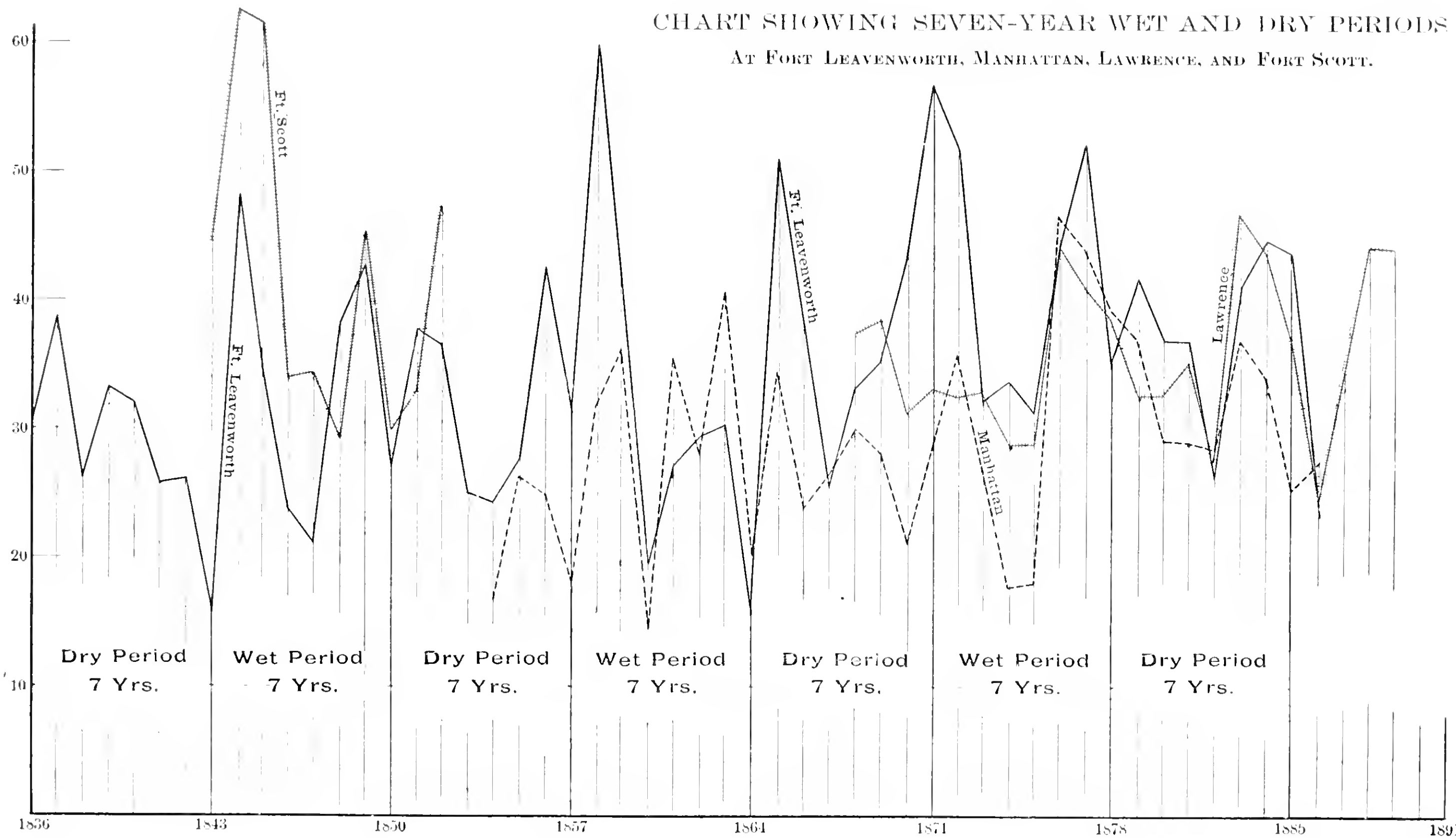
CHART SHOWING SEVEN-YEAR WET AND DRY PERIODS

AT FORT LEAVENWORTH, MANHATTAN, LAWRENCE, AND FORT SCOTT.



three places, and also for Fort Scott. It shows also the division into seven-year dry and seven-year wet periods.

By a dry period we do not mean that each year of it is a dry year. The rainfall of some years, in a dry period, may be greater than that in some years of a wet period. One period is dry compared with another when the mean rainfall of the first period is less than that of the second.

Beginning with the Fort Leavenworth line, we see from it that from 1836 to 1842 there is a seven-year dry period, the mean rainfall for this period being 30.43 inches. From 1843 to 1849 there is a wet period, the mean rainfall for this period being 32.03 inches. Table No. 2 gives the results in tabular form.

TABLE No. 2.

Years.	FORT LEAVENWORTH.			MANHATTAN.			LAWRENCE.	
	Period.	*Mean.*	*Mean.*	*Period.*	*Mean.*	*Mean.*	*Period.*	*Mean.*
1836–'42...........	1st D....	30.43	30.43	....	....	....	....	....
1843–'49...........	2d W....	32.03	32.03	....	....	....	....	....
1850–'56...........	3d D....	31.16	31.16	....	....	....	....	....
1857–'63...........	4th W....	33.82	33.82	4th......	29.22	29.22	....	....
1864–'70...........	5th D....	34.03	33.03	5th......	26.29	26.29	....	....
1871–'77...........	6th W....	43.16	34.16	6th......	30.91	29.41	6th. ...	34.54
1878–'84...........	7th D....	37.89	33.64	7th......	33.25	27.00	7th......	36.71
1885–'91...........	8th W....	37.27	37.27	8th......	29.65	29.65	8th......	38.00

Examining the means in column three, table No. 2, we see that those of the fifth, sixth and seventh periods are larger than those preceding them, indicating a large increase in the rainfall. We will subtract from the mean of the fifth period 1 inch, from the mean of the sixth 9 inches, and from the mean of the seventh $4\frac{1}{4}$ inches, in order partly to eliminate this large increase. Column four gives the means when thus reduced. Examining the means in this column, we see that they are alternately wet and dry, and that each dry mean is wetter than the preceding dry mean, and each wet mean is wetter than the preceding wet mean. Hence, after taking away 100 inches of rainfall from this record, there is left a gradual increase during the whole 56 years covered by the record.

Consider next the Manhattan line: The record of rainfall at this place begins in 1854. This is not the beginning of a period; the first full period of this record (the fourth period of the Fort Leavenworth record) begins in 1857. Column six, table No. 2, gives the means for this place. We subtract $1\frac{1}{2}$ inches from the sixth mean, and $6\frac{1}{4}$ inches from the seventh mean, giving the means in column seven. Examining the means in this column, we find that they are alternately wet and dry, and each dry mean is wetter than the preceding dry mean, and each wet mean is wetter than the preceding wet mean. Hence, after taking away $54\frac{1}{4}$ inches of rainfall from this record, there is left a gradual increase during the whole 35 years covered by the record.

Examining the three Lawrence means, in column nine, table No. 2, we see that the eighth is larger than the seventh, the seventh larger than the sixth. Hence, there has been a gradual increase in rainfall at this place during the 21 years covered by the record.

It should be remembered that the writer does not claim that the rainfall has always been increasing in Kansas, or that it will continue to increase in the future. His conclusions apply only to these three places for the time covered by the record.

ERYTHRONIUM MESOCHOREUM *n. sp.*

BY E. B. KNERR, MIDLAND COLLEGE, ATCHISON.

In the spring of 1890, I was struck with the very early appearance of an *Erythronium* upon the campus of Midland College. At once I observed that, besides its very early appearance, it showed characteristics different from *E albidum* Nutt., chief among which was its slender, unmottled leaves, and the fact that almost every plant bore a flower. All available literature was at once examined, but I could find nothing to agree exactly in description with this plant. As soon as the flowers appeared again, this last spring, I sent specimens to Professor Kellerman, thinking that perhaps he could find a more accurate description in the library of the Agricultural College. But he replied that *E. albidum* came nearest to it, though he admitted that the plant seemed to be an interesting variation. Specimens were then sent to Doctor Trelease, who replied that his attention had been called to the same plant only a few days previous by specimens found in the Missouri bottoms, and that he would be on the lookout for the plant when it should again appear next year. I then published in the May number of the *Midland College Monthly* an account of the plant, under the name of *Erythronium mesochoreum*, in honor of Midland, showing the leading points in which it differs from *E. albidum*, with which it had hitherto been confused. I also sent pressed specimens and bulbs to Prof. Sereno Watson, of Cambridge, and he has kindly given it recognition in his revision of *Erythronium*, as published in his last issue of "Contributions to American Botany," July, 1891, where he says, that the plant was "first noted as a variety of *E. albidum* by Mr. R. Burgess (*Bot. Gaz.* 2, 115), and Mr. M. H. Panton (same, 2, 123); perhaps well separated from that species by Prof. E. B. Knerr (*Midland College Monthly*, 2, 5)."

The points of difference between the two species, upon which I would base their distinction as such, are as follows:

E. mesochoreum is about 10 days earlier in bloom; has much longer and more narrow, unmottled leaves, these being usually from one-fourth to one inch wide, and sometimes as much as 8 to 10 inches long; the perianth is also much longer, sometimes reaching two inches, is never reflexed as is *E. albidum* when in full bloom, and is lavender tinted rather than pinkish. The ovary is oblong, arising from a stipe as thick as its base, while the stipe of *E. albidum* is quite abruptly narrowed. The cross section of the ovary is bluntly triangular, with the sides convex, because of wider partitions, while in the other species they are concave. The capsules are obovate, elongated sometimes as much as 1¼ inches long and one-half inch thick. New corms are developed at the base within the old in both the sterile and fertile plants. In each bulb four or five such corms, arranged somewhat spirally, may be counted, the lowest and outermost furnishing the bud for the plant of the next season. It is quite different with *E. albidum*, where as soon as the leaf is developed the corms send off two shoots bearing enlargements at the ends, which are to become the corms for the next year's plants. These shoots or underground runners vary in length, depending upon the soil, from 2 to 10 inches; but as the great majority of corms are small they send up but one leaf. Only is it the rare exception that a runner has penetrated deep enough and stored sufficient nourishment to send up the following spring two vigorous leaves, bearing in their midst that most beautiful of our spring flowers, the dogtooth violet. As each plant produces two new corms each season, we readily see how a whole hill slope may become thickly carpeted with these exquisitely-mottled leaves. But the plants bearing flowers are few in comparison. Not so with *E. mesochoreum*, for here the blooming forms are the multitude and the sterile (probably only seedlings), appearing later, are the exception. Nor is this species so choice as to habitat, for it is very abundant over all north-facing slopes, whether open and grassy or wooded. In fact, it is found in places where *E. albidum* could not be made to grow.

To recapitulate: The points most especially to be noted as marking the species are, early appearance, more slender aspect throughout, leaves unmottled, perianth only half reflexed at most, flowering forms vastly more numerous than sterile and appearing first, corm rather bulb-like and without runners, and range of habitat more extended. Indeed, the points of difference between this form and *E. albidum* are more numerous and more marked than between *E. albidum* Nutt. and *E. Americanum* Smith.

EXAMINATION OF SOLANUM ROSTRATUM.

BY W. S. AMOS AND L. E. SAYRE, PH. G., LAWRENCE.

The common bull nettle of the fields and roadsides, *Solanum rostratum*, is one of the common weeds belonging to the natural order *Solanaceæ*, familiar to every one —so familiar that any minute description is quite unnecessary. It is very prickly in all parts of the plant; hoary, with a copious woolly, stellate pubescence. It has been our purpose to ascertain whether the plant contained any large per cent. of alkaloid similar to that of other species obtained from this order, such as hyoscyamus, stramonium, belladonna, tobacco, etc.

For the purpose of this investigation, the leaves and leafy tops were selected, and subjected to the following treatment: The air-dried powder was subjected to the temperature of 110 degrees centigrade, in a drying oven, until it ceased to lose weight. The powder, by this treatment, lost 15.5 per cent., which was estimated as moisture. Two grams of the powder were incinerated in a platinum capsule, and the ashes treated with hydrochloric acid and water; the solution, upon examination, gave reaction indicating the presence of calcium, magnesium, iron, sodium, aluminum, silica, phosphoric acid. The powder treated with ether by continuous percolation yielded an extract 3.26 per cent. This extract was of a deep green color, with a resinous, oleaginous and bland taste; odor, strong and hay-like. It consisted mainly of coloring matter and inert resin. The residual powder left after treatment with ether in a continuous percolator was treated with alcohol; the alcoholic tincture was evaporated to dryness, leaving a dark green extract having a heavy narcotic odor, very sharp and oleaginous taste. The yield of alchoholic extract was 6.14 per cent. This alcoholic extract was treated with water acidulated with sulphuric acid, and filtrated, the filtrate rendered alkaline by ammonia and shaken with ether in a separator. The ethereal layer was separated and evaporated, yielding an extract .98 per cent. The color of this ethereal extract was greenish, the odor quite narcotic. Under the lens, small, feathery crystals could be seen. A small portion of the extract was incinerated on a platinum foil, which left a very minute residue. The extract was again treated with acidulated water, to dissolve out any of the alkaloid, and bring it into a pure state. The solution thus made was treated with various alkaloidal reagents—potassio-mercuric iodide, phospho-molybdic acid, tannic acid, platinic chloride—which gave unmistakable signs of the presence of the alkaloid. On evaporating the acidulated solution over sulphuric acid on a watch crystal, and examining under a one-inch objective, numerous minute crystals, acicular and in bundles, were seen.

The residual powder, after treatment with alcohol, was treated with other solvents, according to the method of Dragendorff, with the view of ascertaining whether any alkaloid was left behind in the drug after treating with alcohol. The result was negative.

Inferring from these experiments that alkaloid was present in the drug, that it could be extracted by an alcoholic solvent, an alcoholic fluid extract was then made, each cubic centimeter of the preparation representing one gram of the drug. This was made in quite a large quantity for the purpose of assay.

Assay.—10 c. c. of the fluid extract was put into a separator, and a few drops of solution of ammonia added; to this 10 c. c. of chloroform were added, agitated with 10 c. c. of water, and again agitated. The chloroformic layer, which was easily separated, was drawn off into a second separator, containing 5 c. c. of water to which had been added a few drops of dilute sulphuric acid, agitated, and when the chloroformic layer had separated, it was drawn off into a third separator, containing 5 c. c. of acidulated water, again agitated, and allowed to stand, which allowed the chloroformic layer to separate, which was then drawn off. To the contents of the first meanwhile, were added 10 c. c. of fresh chloroform, which was passed into the several percolators as before. The acidulated aqueous fluids were mixed and rendered alkaline with ammonia, thus separating the alkaloid in a tolerably pure state. The neutralized fluid was washed with three successive portions of chloroform: 10, 10, and 10 c. c., respectively. The chloroformic solution evaporated. The somewhat crystalline residue was dissolved in acidulated water, and the solution divided into two portions, each portion representing 5 c. c. of the fluid extract. This was triturated with solution of potassio-mercuric iodide (Mayer's reagent), NI_{20}, which required .7 c. c. of this reagent. According to Dragendorff, 1 c. c. of Mayer's reagent, NI_{20}, precipitates .00625 of atropine. Estimating the amount of this unknown alkaloid from the above data, we have .00625 multiplied by .7 = .004375, which, multiplied by 20 to obtain the percentage, gives us .087 per cent. The 5 c. c., corresponding to the one just examined, was tested gravimetrically, by adding Mayer's reagent in excess and weighing the precipitate. The precipitate, when dried, weighed .015, which when multiplied by .449, (see Lyon's Pharmaceutical Assaying, page 56,) yielded .094 per cent.

For the purpose of confirmation, still another process of assay was tried, a process recently introduced by Prof. J. U. Lloyd, of Cincinnati: 5 c. c. of the fluid extract were placed in a porcelain mortar, with 1 c. c. of solution of perchloride of iron and bicarbonate of soda added, until a stiff magma was produced; then this magma was extracted by repeated trituration of chloroform. This excludes tannates, gums, albuminates, mineral salts, most vegetable acids and salts, and most coloring matters. Chloroform extracts the chloroform; the alkaloids mixed with the wax, some resins, chlorophyll, and fats. The alkaloid chloroform was extracted by rotating in a bulb separator with repeated portions of dilute sulphuric acid (one part in 50 of water). The aqueous acid solution was extracted in a separator by stronger ether in repeated portions, the ether separating the chlorophyll. The acid solution was neutralized with ammonia and rotated in a bulb separator with chloroform, thus abstracting the alkaloid in a tolerably pure state. The chloroformic solution was evaporated in a tarred dish and the residue weighed. This residue weighed .058, which, multiplied by 20 = 1.160, the percentage of alkaloid, estimated by this so-called easy process.

In presenting the foregoing, the authors are conscious of the fact that any chemical assay is open to numerous objections unless it places before us, in a definite, crystallized form, the active principle that we seek to estimate, and this supplemented by certain physiological tests. These latter points are now out of the question, for the limited time we have had to work. We have, however, a very few crystals of the substance here to present, promising to follow the investigation further as time permits.

AN INEXPENSIVE REAGENT BOTTLE, OF SERVICE IN MICROSCOPIC WORK.

BY PROF. E. B. KNERR, MIDLAND COLLEGE, ATCHISON.

A very convenient reagent bottle, of service in preparing mounts for the microscope, may be made in a few minutes from an ordinary wide-mouth, half-ounce or ounce bottle, a short piece of glass tubing, a bit of rubber tubing, and an ordinary wood cork to fit the bottle.

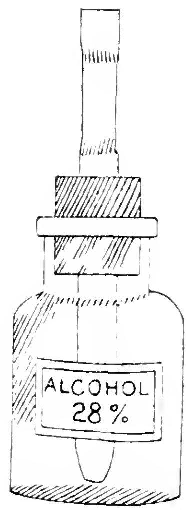


FIG. 1.

Having selected a piece of glass tubing about one-fourth inch in diameter and two feet long, soften it in a flame and draw out to a narrow contraction at intervals of about four inches, then cut off the sections with a file. After about six of these have been made, again cut each one through the middle with a file, and round off the sharp edges of both ends by holding in the flame a few seconds, taking care, however, not to allow the smaller end to close up. In this way enough tubes for a dozen bottles can be made in a few minutes. Next select corks to fit the bottles, and with a cork borer make a hole through the middle of each of proper size to admit one of the glass tubes and hold it firmly. Pass the tubes (each being somewhat over two inches long) through the corks until, when placed in the bottles, the narrow end will almost reach the bottom. This will leave about three-eighths of an inch of the wide end of the tube extending above the cork. Over this protruding portion pass about $1\frac{1}{2}$ inches of rubber tubing one-fourth inch in diameter. Now close the open end of the tube by about one-fourth inch of the core that was removed from the cork in making the perforation, and the bottle is complete. I find it very convenient to have a dozen or more, one for each fluid employed in working about the microscope. These bottles are very inexpensive, the whole dozen costing not morethan a single one of the glass-stoppered, glass-covered dropping bottles, and they work more satisfactorily.

In use, the rubber tube above the cork is first compressed, then the pressure relaxed, thus filling the glass tube with liquid. Cork and tube are now removed together from the bottle, and as much of the liquid as is desired is delivered just where wanted on the glass slip by again compressing the rubber. The cork and tube are now returned to the proper bottle, where they will be in readiness when again wanted, meanwhile serving as a stopper to exclude dust or moisture as effectually as any glass cover ever devised.

This simple device was first described by the author in *The Microscope* for April, 1891, but he again presents it, hoping that it may prove as convenient to others as it has to himself.

FIG. 2.

Upon the same principle, a very convenient pipet may be constructed. by slipping a short piece of rubber tubing over one end of a glass tube which has the other end drawn to a small opening. The open end of the rubber tube should be closed by a piece of cork.

VARIATIONS IN DOMINANT SPECIES OF PLANTS.

M. A. CARLETON, MANHATTAN, ASSISTANT BOTANIST, KANSAS EXPERIMENT STATION.

One of the most important propositions offered by Mr. Darwin, in discussing the subject of "Variations in Nature," is, that "wide-ranging, much-diffused and common species vary most."* One would naturally suppose that such a proposition, if true, could be easily demonstrated by many illustrations from nature, seeing that so many of our native species are far-reaching in their habitat, extending over vast areas of the United States, and even of the American continent, encountering an endless variety of soils and extreme changes of temperature and moisture.

For the purpose of ascertaining how far such a demonstration could be carried out from a study of the most common and widely diffused of our Western species of flowering plants, I have gathered together such notes of original observation and material from reports of other writers as form the basis of this paper. Not having determined upon such a purpose, however, until late in the summer season, I have only collated sufficient material for a preliminary discussion of the subject.

The first thing to impress the careful observer is the fact, often repeated, that that there is variation *everywhere*, and the more carefully one observes the greater the amount of variation that is noted, until it appears to be entirely without limit and becomes extremely delicate and infinitesimal, such as would be wholly overlooked by the indifferent observer.

It may be convenient to look upon the differences arising through variations as being of several grades, namely, individual, varietal, specific, generic, etc., corresponding to the different terms individual, variety, species, genus, etc., used in the classification of the living forms, although the former shade into each other exactly as do the latter.

In discussing the subject at hand, I shall have mainly to do with varietal differences, which, however, are simply individual differences increased, and finally made permanent, through the power of hereditary transmission.

Species of plants tend to accommodate themselves, through variation principally, to four different changes of environment — changes of soil, moisture, light, and temperature. As the territory covered by the notes and observations of this paper is comparatively small, including Kansas, Indian Territory, as far as the Canadian river, Panhandle, Texas, and eastern Colorado (although references will be made at times to other districts), the elements of light and temperature will not be so important as those of soil and moisture.

I shall now continue the immediate discussion of my subject under four different heads: (1) Variations in size, that is, of the entire plant, or any part of it; (2) variations in morphology; (3) variations in the character of the trichomes, or surface appendages; and (4) variations in color, mainly of the flower.

* Darwin "Origin of Species," ch. 11, p. 42.

I.—Variations in Size.

It would be impossible to bring together all the illustrations that might properly be included under this head; and I shall only refer to a considerable number of those cases that furnish the most positive proof of our proposition.

Œnothera serrulata Nutt.—And its forms should probably be placed first in this list of illustrations. It is well distributed over by far the greater portion of the United States, accompanied by a number of described varieties and a limitless number of intermediate forms. There is great variation in the size of the entire plant and of the leaf and flower, the flowers ranging in size from nearly two inches across to a little more than half an inch. Its largest representatives are found eastward, as a rule, and it becomes smaller farther and farther into the sandy districts of the southwest and on the summits of rocky hills. I have myself found at least three distinct forms of this species, with many intermediate grades. The largest form was noted on the prairies of the Pottawatomie country, in central Indian Territory; the smallest on the gypsum hills and in sandy districts of western Indian Territory and Panhandle, Texas, and a form intermediate in various places in Kansas and the other two countries first named. Two large-flowered varieties are mentioned in the manual of western Texas plants* as occurring in that region.

Panicum virgatum L.—One of our most common and widely diffused American grasses—is simply invariable in its variableness. It varies in the general coarseness of the plant and the size of the spikelets. Yet, it may be noted that this species has but one published North American variety (according to Oyster's "List"); and it should be remarked here that one cannot always determine upon the amount of variations of a particular species from the number of its described varieties, as the variations, although quite numerous and extremely diverse, may not be sufficient in *degree* for the establishment of a new variety.

Grindelia squarrosa Dunal—Presents considerable variations in the size of leaf and flower head. Its variety *grandiflora* Gray is well known.

Tradescantia pilosa Lehm.—Very wide ranging: grows gradually, but considerably, smaller, from eastern Kansas to New Mexico.

Other common species that vary in size may be noted, as follows:

Engelmannia pinnatifida T. & G.—Grows smaller to the westward.

Chrysopsis villosa Nutt.—Varies in size of head, and of the whole plant.

Petalostemon violaceus Mx.—Varies extremely, principally in size of heads. A form, seemingly constant, found in Morton county, Kansas, is probably var. *tenuis* Coulter.†

Petalostemon candidus Mx.—Varies also as the last.

Aplopappus spinulosus DC.—Varies in size of heads.

Then there is the great host of asters and solidagos that vary so much that the varieties, and even some species, with their multitude of intermediate forms, present almost inextricable confusion. Among them may be mentioned:

Aster multiflorus Ait.

A. ericoides L.

A. salicifolius (Lam.?) Ait.

Solidago canadensis L. with several varieties.

S. missouriensis Nutt. and numerous varieties.

S. serotina Ait.

S. occidentalis Nutt., etc.

All these are extremely common and wide ranging.

*J. M. Coulter, "Manual of the Phanerogams and Pteridophytes of Western Texas," page 117, No. 23.

†Coulter—"Manual of the Phanerogams and Pteridophytes of Texas," Polypetalæ, p. 79, No. 4.

II.—VARIATIONS IN MORPHOLOGY.

Variations in the form of the *leaf* seem to be the most common under this head.

Callirrhoe involucrata Gray—Is one of the most variable, in this respect, of our common species. The form of the leaf ranges from entire to many cleft, while even "the segments themselves may be lobed."

Vitis riparia Mx.—Also presents great variations in form of the leaf, ranging from entire to deeply 3-lobed.

Several species of *Phaseolus*, quite common, show great variations in leaf morphology, especially in *Phaseolus diversifolius* Pers.*

Grindelia squarrosa Dun. and forms—Show great variations in the form of the leaf, and involucral bracts especially.

Variations in the forms of compound leaves are very diverse, and were fully and ably discussed in a paper at the preceding meeting of this Academy of Science.†

Carex straminea Schk.—Is well known to be extremely variable, and also common. It varies principally in the form and arrangement of the spike and spikelets. It has a number of published varieties, and numberless intermediate forms.

Carex laxiflora Lam.—Varies also as the last, and in the form of the leaf. Very common.

There are many instances known of the doubling of flowers among common species, but these seem to be monstrosities, appearing only for a time, as there is apparently no case on record, so far as I know, where such variations became constant among wild plants.

Other species that may be added are:

Œnothera sinuata L.—Varies in form of leaf.

Gaillardia pulchella Foug.—Varies in form of leaf.

Verbena bipinnatifida Nutt.—Varies in form of leaf.

Anemone decapetala L.—Varies in form of leaf.

Aplopappus spinulosus DC.—Varies in leaf morphology.

Panicum crus-galli L.—Varies in all parts.

Senecio douglasii DC.—Varies greatly in form of leaf.

III.—VARIATIONS IN TRICHOMES.

Aplopappus spinulosus DC.—Is one of the most variable species in the develop-of trichomes, and, at the same time, a very common species, and widely diffused. It varies from smooth to whitish woolly, with all intermediate forms. Have collected three different forms at Tascosa and Canadian City, Tex.—one of them entirely smooth. Reported from Colorado with "soft, minute woolly pubescence.‡

Chrysopis villosa Nutt.—"Extremely variable in the size and shape of the leaves, in the number of the flower heads, and in the *kind and amount of pubescence*. It includes several *nominal* species. Common *everywhere*, at *all* elevations." §

The above description of this species is so completely confirmed by my own observations, that I copy it entire. Have collected specimens, showing several stages in the development of trichomes, at different places in southwest Kansas, western Indian Territory, and Texas panhandle.

Others may be added, as follows:

Engelmannia pinnatifida T. & G.—Flower heads more hairy, seemingly, farther westward.

* A recent revision makes this species *Strophostyles angulosa* Ell. (Watson in Gray's Manual, 6th ed., p. 145).

† Mrs. W. A. Kellerman—"Evolution in Leaves," Trans. Kas. Acad. Sci., vol. XII, part 2, p. 168-173.

‡ Porter & Coulter—"Flora of Colorado," p. 65.

§ L. c., p. 67.

Rudbeckia hirta L.—Plant more hispid in some localities than in others.

Œnothera sinuata L.—Varies in the amount of pubescence.

Grindelia squarrosa Dun.—Considerable variation in the degree of viscosity.

Senecio douglasii DC.—Varies extremely, from glabrate green to white tomentose. Very common all over the southwestern great plains.

Riddellia tagetina Nutt.—Varies in amount of pubescence, and is quite common.

Several species of *Astragalus* vary extremely in the amount of pubescence, especially *Astragalus lotiflorus* Hook.

IV.—VARIATIONS IN COLOR.

Viola tricolor L.—With its various forms, is perhaps the most variable in color of all our common species. The color of the flower is of all shades from "purple through white to yellow," and it is well known that from it have sprung all our cultivated pansies, with their many and variegated colors.

Oxalis violacea L.—Often presents pure white flowers, in certain isolated spots.

Viola palmata L.; var. *cucullata* Gray—Often shows white flowers, especially in woods.

Lepachys columnaris T. & G., with its var. *pulcherrima* T. & G., and intermediate forms, are striking examples of variation in color. Illustrations of all the various shades, graduating from the one extreme to the other, can easily be found in southwest Kansas.

Lepachys tagetes Gray—Presents various shades of color in flowering, exactly corresponding to those of the last. Have collected the various forms in southwest Kansas. This species, however, does not seem to be very widely diffused.

Others may be added, as follows:

Tradescantia virginica L.—Various shades of purple, blue, and red.

Sisyrinchium mucronatum Mx. and

S. anceps L.—various shades of blue.

Callirrhoe involucrata Gray—Various shades of purple and red, and sometimes nearly white.*

Aster multiflorus Ait.—White and intermediate shades to blue.

Phlox divaricata L.—All shades, from violet to white and red.

Schrankia uncinata Willd.—Deep red to nearly white (rarely pure white, as noted in western Indian Territory).†

Andropogon provincialis Lam., and *Panicum crus-galli* L.—Vary greatly in color of all parts of the plant.

I shall now mention, on the other hand, a number of the most striking illustrations, among hundreds of others, of *constancy* in species. Nearly all are quite uncommon, but usually wide ranging:

Peucedanum nudicaule Nutt.—Quite rare, in my experience.

Lithospermum hirtum Lehm.—(Slightly variable in color of flower.)

Redfieldia flexuosa Vasey—In sand hills of the Southwest.

Castilleia sessiliflora Ph.

Nasturtium sessiliflorum Nutt.—(Slight variableness.)

Atriplex expansa Wats.—Southwestern great plains.

Cleomella angustifolia Torr.

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*As observed by the writer on North Canadian river, in neutral strip, Indian Territory, August, 1891.

†In Cheyenne and Arapahoe country, near a "black jack" grove, in the vicinity of Kingfisher. There the writer saw the most beautiful wild garden of these "sensitive roses" that he ever observed. It was a brilliant sight; and among the innumerable large specimens that fairly matted the ground were a few with pure white flowers.

Astragalus bisulcatus Gray.
Dalea alopecuroides Willd.—(Somewhat wide ranging, but not common.)
Erigeron annuum Nutt.—(Wide ranging, but uncommon.)
Kochia americana Wats.—(Restricted to saline soils.)
Lupinus pusillus Ph.—(In sandy districts.)
Gaillardia simplex Scheele—Quite rare in my experience.
Oxytropis monticola Gray—Also rare.
Psoralea argophylla Ph.
Dalea lanata Spreng.—(Rather plentiful, only in sandy districts.)
Petalostemon villosus Nutt.—(In sandy districts.)
Townsendia sericea Hook.—(Rather wide ranging, but uncommon.)

In concluding, I would urge that more attention be paid, in collecting specimens, to intermediate forms, or even monstrosities. If the main object in the teaching of natural history is to impress upon the mind of the student nature's laws of progressive development, and the wonderful adaptation of species to changes of environment, through variation and natural selection, is not this very object defeated by our efforts, usually, to have only perfect or typical representatives of species in our herbaria? Let all forms of different species be represented as nearly as possible. Let it be the *effort* to do this rather than to avoid it, even though by so doing we may not be able to accumulate so great a number of species. By these means, the student will be brought face to face more with the facts of nature as they *are*, and be taught by more natural and rational methods.

THERAPEUTIC VALUE OF SOME RECENTLY-INTRODUCED CHEMICALS.

BY L. E. SAYRE, PH. G.

Within the past few years, considerable attention has been paid to the physiological action and chemical constitution of many of the organic and synthetical preparations of the chemist. Many of these have been introduced into medicine under the title of new remedies. The study of the relation of physiological action and chemical constitution, according to a certain class of practitioners, has a promising future before it.

It will be impossible, in a short paper, to dilate upon the relations above referred to, but a few remarks relating to the benzine series may be at this time in place. It is well known by the chemist that when benzine (C_6H_6) is decomposed by substituting OH for H in that compound, we have a powerful antiseptic and disinfectant, known as carbolic acid. An antiseptic of a very different nature is produced when one equivalent of H is substituted by carbhydroxyl COOH. The name of this compound is well known as benzoic acid. Still another important antiseptic and antipyretic is made by substituting two atoms of H of the benzine, one with OH, and the other with COOH, forming hydroxybenzoic acid or salicylic acid. This remedy, too well known to need description, is one of the most prominent of the therapeutic agents of this kind, used as an external and internal remedy.

The study of the ortho, meta, and para substitution products of benzine—the manner in which ethyl, methyl, propyl, etc., is combined in the "benzine ring," has occupied, for example—has been of intense interest. As before stated, I cannot do more than refer to these compounds, and in doing so shall select a few which have a very apparent relation to benzine; shall refer in a very brief way to this relation and also note physiological action.

Antifebrin of acetanilid is a preparation in which the H of the benzine is substituted by $NHCH_3CO$, making phenyl acetamide ($C_6H_5NHCH_3CO$). This is an antipyretic sedative and nervine. Introduced in 1886. Dose, 2 to 15 grains.

Antipyrine has the composition of $C_6H_5(CH_3)_2C_3HN_2O$. This is a phenyl-dimethyl compound; it is another powerful antipyretic, used in typhoid and other fevers, in doses of 5 to 30 grains; introduced in 1884, by Doctor Knorr. Still another antipyretic, introduced recently under the name of antithermine, has a somewhat complicated relation to benzine by substituting one atom of H for a very complicated organic compound, so that its formula reads as follows: $C_6H_5N_2H_2$ $CH_3C(CH_2)_2COOH$ (phenylhydrazin levulinic acid). This is related to antipyrine, but has never come into great popularity in the medical profession. There are other antipyretics, such as benzanlid, which is a phenylbenzamide, having the formula of $C_6H_5NHCOC_6H_5$. There is also phenyl methane, having the composition of $(C_6H_5)_2CH_2$, a crystalline substance having an odor like orange, insoluble in water, but soluble in alcohol and ether. Its dose is about one-half of that of antipyrine.

Recently Professor Stilling has introduced an article under the name of pyoktannin, superior in any way to corrosive sublimate for dressing wounds, ulcers, and pus-forming sores of all kinds; being nontoxic, it can be used in any quantity with impunity. Cases of cancers and tumors have been reported cured by injection of this remedy. Upon investigation, it has been found that this remedy is none other than aniline ($C_6H_5NH_2$), deprived of all traces of arsenic.

It may already have been suggested to you that when aniline (an antiseptic) is brought into combination with methyl compounds this interesting organic compound is converted into an antipyretic, and this antipyretic property varies according to the arrangement of this compound, whether ortho, meta, or para.

Among the first chemists to notice the remarkable antiseptic properties of aniline was Doctor Custman, of the Missouri Medical College. Many others abroad noted the fact about the same time. Since this time organic and synthetic chemists have been very energetic in studying substitution products of this article, and working hand in hand with them have been the pioneers in therapeutic practice, who have taken the other line of investigation, and studied the therapy of these. The joint study has given a new impetus to both these branches of science — has brought medicine and chemistry more closely together, and bids fair for valuable fruit in the future.

TWO RARE BIRDS OF KANSAS.

THE WHITE-FACED GLOSSY IBIS (Plegadis guarauna) AND CLARKE'S NUTCRACKER (Picicorvus columbianus).

BY A. M. COLLETTE, EMPORIA.

The first specimen of the white-faced glossy ibis taken in the State was a young male, shot at a lake near Lawrence, by Mr. W. L. Bullene, in the fall of 1879. It is now in the fine collection in Snow Hall, at the State University.

The second, a young female, was captured October 17, 1890, on the Arkansas river, near Wichita, by Dr. R. Mathews.

The third, an adult male, was shot out of a flock of 20, on a pond near McPherson, April 29, 1891, by J. W. Blair, and sent to Professor Kelly for identification, who now has it in the State Normal museum. This is the first adult bird of the kind taken in the State. The measurements are: Length, 23.75; stretch of wings, 37.00; wing, 10.55; tail, 4.25; tarsus, 4.00; bill, 5.50; middle toe, 3.30.

The plumage of this beautiful wader is glossed with a metallic luster, which shines with different colors in the varying shades of light, but at a distance appears black, and is generally known as the "black curlew."

In flight, its legs and neck are stretched out to their full extent. Upon dissection, I found its food to consist principally of snails, with a few fish.

They are found in the western United States, from Texas to California, north to Oregon, accidental to Kansas, and south through tropical America to Chili.

The nest is composed of broken cane and rushes, placed upon the tops of the living ones as a foundation. They are generally located in marshes and lagoons, in company with the herons. Eggs, usually three, 1.95 x 1.35; color, deep greenish blue.

The second appearance of Clarke's nutcracker in this State was a flock of five, seen on the Neosho river, north of Emporia. Mr. R. Evans, a student of our school, shot an adult male from this flock October 9, 1891, which was placed in the museum at the Normal.

They are an accidental visitant in Kansas, the first one being taken August 13, 1888, by Mr. Chas. Netz, near the south line of Marshall county. They are found in the high, coniferous forests of western North America, south to Arizona, east to the edge of the plains, but are seldom found below an altitude of 4,000 feet. The general color is bluish ash, gradually fading to white on the head; wings, greenish black. This bird has the habits common to several other species.

Like the woodpecker, it clings to the side of the trees while it hunts for the various forms of life found within; and in flying its motions are similar. It is wild, restless, and noisy like the jay. When on the ground, it walks like a crow.

Clasping with its sharp claws the cones of pines, with its peculiarly shaped bill it gouges out the seeds, which are its principal food. It often hangs, while thus engaged, with head downward, swinging back and forth, reminding one of the titmouse in its movements.

The measurements of the one I procured are as follows: Length, 12.50; stretch of wings, 22.00; wing, 7.50; tail, 4.50; tarsus, 1.20; bill, 1.50. The nest is rather bulky, composed of sticks and twigs lined with small vegetable fibers; at first appearance reminding one of a squirrel's nest. Average size of eggs, 1.22 x .92. Their color is light grayish green, irregularly spotted with a deeper shade of gray, chiefly around the large end.

ALL ENERGY IS KINETIC.

BY E. B. KNERR, ATCHISON, KAS.

One of the most perplexing subjects to the minds of students in physics is the subject of so-called "potential energy"—perplexing because the student is dealing with a fallacy. The term in itself is a contradiction, meaning, as it is usually accepted, "possible energy." Now, the nature of energy is such that it either is or it is not; there can be no such a condition, in strict science, as a "possibility" for it. In short, there is but one energy, and that is all "kinetic," always.

The mathematical formula for energy stands $E = \frac{1}{2} M V^2$, which means that the energy of any body of matter is equal to one-half the product of its mass units into the square of its velocity units. Now clearly, unless a body have motion, it can have no velocity, and if it have no velocity it certainly can have no energy: for if we substitutute zero for V in the above formula it works out that $E = 0$; that is, when the body is at rest it possesses no true energy. But it may be objected that the formula is for "kinetic" energy, and hence will not apply to "potential" energy. Will some one, then, kindly supply us with a mathematical formula applicable to this very peculiar form of "capacity for work" (the usual definition for energy). The formula so given must be reducible to the general formula for energy ($E = \frac{1}{2} M V^2$) else evidently it can represent nothing in common with true energy whatever. But, whoever makes this formula, let him remember that, as soon as V becomes zero, E also becomes zero. Clearly, then, the only energy is energy of motion—kinetic energy.

How then explain those illustrations of "potential" energy so common to modern text-books on physics, such as placing a weight on a shelf, throwing a stone upward till it comes to rest, or the "storage of solar energy" in coal, or the winding of a spring, or any of the many other illustrations that might be cited?

We will take the case of the throwing of a stone upward into space, as it is the one most usually presented. As commonly given, it is about as follows:

If a boy cast a stone upward, the moment it leaves his hand it is possessed of a certain amount of kinetic energy imparted by the boy's strength exerted in the act of throwing. But the stone loses motion gradually, and after a few seconds comes to rest: then instantly begins to return to earth, and finally strikes with the energy it had on starting. The kinetic energy the stone had on leaving the hand is gradually converted to "potential" energy, until, when it reaches the maximum height, it will have no kinetic energy, for it is at rest; but will have an equivalent "potential" energy. It will have a certain "advantage of position," for if it is allowed to fall to earth it will be capable of performing as much work as was done upon it in placing it in that position. Thus the books explain it.

Now let me ask how much "potential" energy that same stone would have when it comes to rest, had it been thrown horizontally over the smooth ice of a frozen lake. Unquestionably it will have no energy, for the energy of motion imparted to the stone as it was cast over the ice is gradually converted to heat energy, as it meets atmospheric resistance and impinges against the ice.

So exactly in the case of throwing the stone upward. It starts with considerable energy of motion, a part of which, owing to atmospheric resistance is turned to heat; but the greater remainder is gradually overcome by the continually-acting counter force of gravity; so that, when the stone has reached the maximum height, the total reaction has just equaled the total action. There has been no storage of energy whatever in the stone. Where, then, is the energy the stone had when it began its ascent? The law of conservation of energy demands that it must exist somewhere. We noticed that it was gradually leaving the moving body, for the velocity was uniformly diminished. Whither did it go? It is not in the stone in any of the forms familiar to us as heat, light, electric or life energy; nor is it there as energy of motion, for the stone is now at rest. Where, then, can it be? *It exists as energy of gravitational force*, not in the stone, but in that rarest of mediums, the "fourth state of matter," the luminiferous ether, whose vibrations constitute the *force of gravity*.

To say that the stone was possessed of a certain amount of "potential" energy *before* it was started upward, by virtue of which it would be possible for it to rise, overcoming atmospheric resistance and gravity, would be no more absurd than to declare it possessed of "potential" energy when once it had reached the highest position in its path, by virtue of which it could fall to earth and do exactly the equivalent of work performed upon it to raise it to that position. The only difference in the two cases is, that the boy cast the stone upward, while gravity hurled it back. We might, with equal propriety, affirm that, after the stone cast over the ice had come to rest, it had acquired "energy of position," as to say a like thing of this stone as it turns to descend from mid-air. Should the boy run over the ice after the stone and push it back with his foot, starting slowly, but gradually increasing his speed until he reached his first position, we all would consider this a new problem, having no connection whatever with the throwing of the stone; for the boy might have returned with another stone equal in weight, and the result would have been the same, so far as the necessary energy was concerned. Likewise must we consider the return of the stone to earth a fact separate and distinct from the rising of the stone.

As the stone falls, we observe it acquiring increased energy, for its velocity is increasing. This is only a further illustration of the transformation of energy of gravity force to the energy of a moving mass. It is but another evidence that gravity is a correlated force.

"Potential" energy is sometimes defined as "energy of position," and in a popular text-book on physics we find the question: "What has become of the energy expended in the building of the Egyptian pyramids?" The author does not give the answer, but from the text it is evident that he would say that it is "stored" in the stones as "potential" energy, or "energy of position." Now, how can position have energy? or, how can matter have energy by virtue of "advantage of position?" Nothing but matter can have energy, and then only by virtue of its motion. The energy exerted in raising the stones to their present position is not in the stones, but as they were lifted against the force of gravity that energy was transformed to gravity energy.

Sometimes "potential" energy is regarded as a form of suspended or arrested energy. This conception is directly antagonistic to the law of conservation of energy, which teaches that the sum total of energy is a constant, never increased or diminished. Now, if energy be arrested or suspended for a moment, is it not for that length of time practically destroyed—gone out of existence—diminishing the sum total to that extent? And if it may be arrested for one moment, why not for a longer time—an hour? And if for an hour, why not for a day, a year? Why not for eternity? Why may it not be annihilated? Clearly true energy cannot be suspended for the smallest fraction of time. When motion of a mass is transformed to heat of a mass by friction, for instance, there is absolutely no interval of time required for the transformation of any particular portion of the energy. It is now motion, and now instantly it is heat.

If this be truth, it may be asked whence the heat energy of burning coal? The books say it is the solar heat and sunshine of ages ago "stored" in the coal as "potential" energy. It is surprising that such a blunder should be so long-lived; for consider now what takes place when a piece of coal burns. The coal of itself cannot burn; it requires oxygen with which it may unite, and the process of combination is called burning. Then why not affirm that the heat is derived from the potential energy stored in the oxygen? That certainly would be as reasonable as to declare that the energy was started in the coal. Why not give the oxygen at least half the credit of carrying all this power these ages? In the growth of the plants which were afterwards transformed into coal, the sun's rays of heat and light played an important part indeed in enabling the plant chlorophyll to separate the carbon from the oxygen of the carbon dioxide, derived, for the most part, from the surrounding air; but by no means could the energy of that heat and light be "shelved," as it were, in the carbon and oxygen thus separated. Rather this energy was transformed to chemism, an active kinetic energy, a vibration of oxygen atoms in the oxygen molecule, and a vibration of carbon atoms in the carbon molecule, or, more correctly, a vibration of the atoms of the complex molecules forming the vegetable structure. The sum of the amount of vibration in the oxygen molecules, as such, and the amount of vibration in the vegetable molecules, is more than was the amount of atomic vibration in the carbon dioxide before it was separated, by just that degree of energy represented by the solar heat and light employed in the separation. But, to induce this higher rate of vibration necessary to the existence of the new molecules of oxygen and carbon, is not storing energy in those molecules any more than it is "storing energy" to convert the energy of motion of a revolving armature to electricity. In short, the energy of the sun's heat and light is converted to chemism, a form of kinetic energy. When now, ages after those plants have grown and fallen to earth and become coal, the conditions being made favorable for the carbon to unite with oxygen, they combine; chemism is again transformed to heat and light.

Would it not be well for authors of text-books on physics to drop this very meaningless and annoying expression of "potential" energy? Let the student be taught that all energy is kinetic. Let him know that if energy disappears in one form of motion it surely appears in some other form of motion, and that to speak of a body at rest as having any kind of energy whatever is an absurdity.

SOME STATISTICS RELATING TO THE HEALTH OF COLLEGE WOMEN.

BY GERTRUDE CROTTY, LAWRENCE.

"Paris," writes Colonel Higginson, "smiled for an hour or two, in the year 1801, when, amidst Napoleon's mighty projects for remodeling the religion and government of his empire, the ironical satirist, Sylvian Marechal, thrust in his 'Plan for Prohibiting the Alphabet to Women.'" I hope you, in the year 1891, will find occasion to smile at the thought that woman should not attend college, because, as is claimed, of her mental inferiority to men, or her physical inability to endure college training. If her mind is weak, then it ought by all means to be strengthened, provided always that it is not done at the expense of her physical welfare. But it is not my purpose to consider woman's mental strength, as compared with that of man, or to treat of her mind in any respect, except in so far as study affects her mind, and her mental condition affects her health.

Doctor Beard, an eminent physician and psychologist of New York, in investigating the effect of scholarly employment upon the length of men's lives, computed the lives of 500 men of mental attainments—poets, philosophers, scientists, educators, lawyers, physicians, etc.—and found the average age to be 64 years; while the average life of the masses was but 50 years, and even then only those who lived to be 20 years of age or over were included in his calculation. The average age of 100 brain workers of our own time he found to be 70 years. If mental occupation is instrumental in lengthening men's lives, why may not women likewise profit by it?

We hear a great deal of complaint to the effect that the American woman is physically inferior to the women of Europe—of Germany. And only too often are we told that this physical weakness is the result of confinement in schoolrooms, and of overtaxing of brains and nerves. But do these criticisms concerning physical infirmities hold good for the American woman alone? Innumerable statements have been made by foreigners who visit America to the effect that the American—the man as well as the woman—lives too rapidly—works too hard, lives upon his nerves, eats too much, sleeps too little, takes too few holidays and too little healthful, mental recreation. May not, in all justice, a share of the American woman's frailty be ascribed to the above causes, rather than to her excessive schooling? Moreover, custom demands less outdoor sport for girls than for boys. The American woman walks less than her English sister. The American must traverse so much greater distances in order to get anywhere, that only artificial transportation is feasible. Again, the climate in many parts of America is not as conducive to comfortable walking as is that of England. The American girl does not walk in the fields with her governess, but is sent to public schools. Here she might have the benefit of healthful games upon the playground, but propriety forbids to her baseball, blackman, tree climbing, and various harmless sports. On the other hand, she is told from earliest childhood that she must "try to be a little lady." The significance of this remark is that she must engage in no sports with her brothers, or she will become a "tomboy." As a result, she becomes a listless, conscious, artificial child.

But our present styles of clothing are doubtless no less injurious to physical development than lack of exercise, air, and cheerfulness. I quote from another, that "all this martyrdom to propriety and fashion tells upon strength and symmetry, and the girl reaches womanhood a wreck; that she reaches it at all, under these sufferings and bleached-out conditions, is due to the superior elasticity to resist a method of education which would have killed off the boys years ago." This statement may be rather strongly put, yet you will readily recognize the approximate justice of it.

It is very difficult for us to grow out of our prejudices; but there are very few people to-day who will agree with Lessing, the great philanthropist, that "the woman who thinks is like the man who puts on rouge—ridiculous;" and we smile at the quaint saying of Simon of Athens, "If there sit 12 women at the table, let a dozen of them be—as they are." In so far as we may retain all our womanliness, I trust we shall remain as we are. But culture is in no wise incompatible with womanliness. I hope the two words will become synonymous.

Those who claim that woman is physically too weak to endure the strain of a college course base their arguments upon the statements that she possesses a peculiarly nervous organization and a small brain; that her fewer ounces of brain will forever debar her from reaching what man has attained; that her brain is not an inventive one, and that she will waste her time and strength in striving after the unattainable. Whether women may accomplish what man has accomplished, whether she can or ever will be enabled by cultivation to invent, are questions we will not discuss; but whether she can endure the physical strain of acquiring an education, we may, in the light of statistics, consider.

There have been, of course, numerous adverse articles written by scholarly men, and even by women; but allow me to quote from a letter written by Professor Huxley to the *Times*. He says: "We hear a great deal lately about the physical disabilities of women. Some of these alleged impediments no doubt are really inherent in their organization, but nine-tenths of them are artificial—the product of their mode of life. I believe that nothing would tend so effectually to get rid of these creations of idleness, weariness, and that over-stimulation of emotion, than a fair share of healthy work, directed toward a definite object, combined with an equally fair share of healthy play during the years of adolescence; and those who are best acquainted with the acquirements of an average medical practitioner will find it hardest to believe that the attempt to reach that standard is likely to prove exhausting to an ordinarily intelligent and well-educated young woman."

The reviewer for the *Popular Science Monthly* writes of a lecture on "The Establishment and Maintenance of Brain Health," delivered at Edinburgh, by Dr. J. Batly Tuke: "Among women, idleness and ignorance are much more prolific causes of disease than overwork. It is not work, but worry, that kills the brain. The most highly-educated and hard-working women the lecturer knew were eminently healthy." One other quotation seems so applicable to the subject in question that I cannot refrain from adding it: "Brain work is the highest of all antidotes to worry; and the brain-working classes are, therefore, less distressed about many things, less apprehensive of indefinite evil, and less disposed to magnify minute trials, than those who live by the labor of the hands. To the happy brain worker, life is a long vacation; while the muscle worker often finds no joy in his daily toils, and very little in the intervals. Scientists, physicians, lawyers, clergymen, orators, statesmen, literati, and merchants, when successful, are happy in their work, without reference to the reward, and continue to work in their special calling long after the necessity has ceased."

Those who have given the subject attention are willing to grant that mental occupation, freedom from morbid self-contemplation, is conducive to good health. We are cured of our imaginary illnesses when we have forgotten them in our absorption in some foreign theme. Women, it is said, are more imaginative than men; spend more time in daydreaming. In their poverty of experience in the world of thought, the imagination is naturally directed toward the ego.

Statistics relating to the health of college women are beginning to multiply, and they furnish abundant proof that "study is the discipline and tonic that most girls need to supplant the too great sentimentality and useless daydreams, fostered by fashionable idleness and provocation of nerves, melancholy, and inanition," and prove, so far as statistics can, that "the woman graduates of those colleges make as healthy and happy wives and mothers as though they had never solved a mathematical problem or translated Aristotle."

What a fruitful and healthful field for the imagination a woman will find in classics, history, the Arthurian romances, Shakespeare, or the Chanson de Roland! The mind refreshed for the first time by these must feel as though it were liberated from a dungeon. The awakening of a woman's mind to the beauties of literature, thought, nature, will always, I suppose, be one of the favorite themes of the novelist. Let me recall to your minds a few sentences from Charlotte Brontë's description of one of her characters, Frances, in "The Professor." "Frances did not become pale or feeble in consequence of her sedentary employment. Perhaps the stimulus it communicated to her mind counterbalanced the inaction it imposed on her body. She changed, indeed, changed obviously and rapidly; but it was for the better. When I first saw her, her countenance was sunless, her complexion colorless. She looked like one who had no source of enjoyment, no store of bliss anywhere in the world. Now, this cloud had passed from her mien, leaving space for the dawn of hope and interest, and those feelings rose like a clear morning, animating what had been depressed, tinting what had been pale," and thus the description continues. Possibly Frances was stimulated to study not by her love of learning alone. Every one has the fortune to have met at least a few cultured women. The graceful expression of thought and countenance, the tone of the voice of a cultured woman, are indescribably fascinating.

But we must hasten to our statistics. Swathmore, a Quaker college, claims "steady" improvement in the health of its girl graduates. The Association of Collegiate Alumnæ has collected statistics relating to the health of college women. These statistics have been incorporated in the report of the Massachusetts labor bureau. According to this report, returns have been received from 12 institutions that have graduated 1,290 women. Of these 1,290 graduates, 54.65 per cent., or 705, have reported: 19.5 per cent. of the 705 report deterioration in health during attendance at college; 59.3 per cent. report no change, and 21.1 per cent. an improvement.

A great deal is said, even in Kansas, about girls not being strong enough to attend college, and, by those who are, perhaps, not friends of the State University, about the injury to the physical welfare of girls caused by climbing the hill upon which the University is situated. These same people who complain enjoy a summer of mountain climbing in Colorado unattended by any physical injury. Six years of observation at the University tell me that very few of the girls themselves make or have occasion to make any such complaint. Occasionally a girl, humiliated at her mental inability to meet the requirements of the University, severs her connection with the University "on account of her health." The young men, under similar circumstances, are obliged to "go into business."

In all justice, let it be said, occasionally a girl breaks down from overwork. Women who have never attended college sometimes overexert themselves. But I am inclined to believe that, in almost every instance, if a girl breaks down attending college, this failure in health can be traced far more readily to social indulgence or to some other neglect of the primary rules of health than to her mental occupation. In order to test the accuracy of my impression, a list of 18 questions concerning the manner of living and studying while in college was sent to the women who have been graduated from the State University. Some one might object, however, that only the stronger women completed a college course. In order to meet this objection, a similar list of questions was sent to all the women who were undergraduates last year. In the collegiate department of the school year 1890–'91, there were 57 women in attendance, excluding those who were members of the senior class. Nineteen of the 57 did not return this fall. Upon comparing this falling off in proportion to the attendance with that of other years, it was found to be the average. Of the 19 who have not returned this fall, 8 are teaching, traveling, or attending other schools; 2 are detained on account of ill health; 3 dropped out the first month of last school year; and 6 were not entered by the University, being excluded by our double-failure rule. Therefore, 35 have returned to the University this fall.

To the questions sent out to the women of last year, 35 replies have been received, 33 of which came from women in attendance this year. Five who have returned have not replied. Nineteen of the 35 who replied report that their health is the same in college as before entrance. Three report worse health while at the University. One of the three attributes this difference to financial and domestic troubles rather than to study. Two entered who had consumption, and both lost strength. One of the two, however, was sent home last year on account of the double-failure rule. Two others, who did not reply, are to my knowledge, ill: consequently, four in all, and possibly five, are detained on account of physical inability. Twelve report health since coming to college as decidedly better. This improvement they attribute to more regular habits of life: they eat at certain hours, eat less between meals, arise and retire at the same hours. College, they say, forces them to systematize their work. Others attribute this improvement to their calmer mental condition; they derive satisfaction — peace of mind — from the knowledge that they are accomplishing something, or, in their enthusiasm and appreciation for their studies, they "forget about themselves." Two out of the 35 thought the walk up the hill injurious, and two complained, not about the hill, but the stairs at the University. Only three or four take systematic exercise. Thirteen assist in making their own wardrobe, and 30 take care of their own rooms.

The same list of questions was sent to the graduates. The State University of Kansas has graduated 101 women in all from the regular collegiate courses. Three of the graduates have died, while the addresses of three others could not be obtained; therefore, 95 communications were sent; 55 replies have been received; 32 of the 55 report health in college the same as before entering; 8 report health worse while in the University — 2 of the 8, however, for a portion of one year only; 11 report health while at the University much better than before entrance. All those who reported (and many did so report) "If there was any change, it was for the better," were included in the list "health the same." Forty-one report health since leaving school "good," or "the same;" 6 report health "better since graduation," and 6 "health not so good;" 35 consider that University life has no effect upon health at all; 4 believe that health is injured by University work, and 9 state that their health was much improved by their college experience; 3 report "climbing the hill" injurious, and 44 not injurious; on the other hand, many consider the hill "a blessing." The alumnæ spent, on an average, 9½ hours per day in study and recitation. Twenty-one of these 51 who have reported are married.

I wish I could tell you all the valuable suggestions sent to me in reply to the question, "What suggestions would you make in regard to improving the physical health of Kansas State University women?" Space, however, will forbid the inclusion of but one or two of these replies. Many of the graduates suggest that the girls should avoid too much social recreation of one character — dancing; but urge that more frequent formal receptions and social gatherings, at which the girls could meet and talk with cultured people, would be a lasting pleasure and benefit to them. All are unanimous in the wish for a gymnasium, in which the girls could receive systematic physical training.

NOTES ON SOME NEW SPECIES OF FOSSIL CEPHALOPODS.

BY ROBERT HAY, F. G. S. A.

Five years ago the writer obtained, from strata that he has been calling permo-carboniferous, near Junction City, a fragment of a large nautiloid cephalopod. Having the impression that the fossils of the region had been exhaustively examined, he kept it without special note, not seeking then to have its species identified. Three years ago a fine cephalopod of a distinct type was given to me by Capt. Geo. E. Pond, quartermaster of Fort Riley, who had obtained it from the quarries worked on the military reservation. I obtained others about the same time from nearly the same horizon, further to the southwest. Captain Pond was also making a collection to go to the museum at West Point, and I undertook to have them named for him. The result was, I sent his collection and my own to Prof. Alphæus Hyatt, of Boston, our best authority on cephalopods. This was early in 1890. About the same time Professor Hyatt received a collection from the geological survey of Texas, from about the same horizon, and he also examined a number of specimens in the National Museum, at Washington, that had been sent from Kansas by Doctor Newlon, of Oswego.

Among the Texas specimens were some of the same species as those from Geary county, Kansas, but most of them, whether from Kansas or Texas, were new species. Three from Doctor Newlon were also new species, one of them being a new genus.

All the species have been described by Professor Hyatt in the recently issued Second Annual Report of the Geological Survey of Texas. Dr. Newlon and myself have had our names given to one species each, and one species of which the type specimen was also from Kansas has been named for Professor Dumble, the director of the Texas survey. The entire list is as follows:

Temnocheilus crassus, Oswego.
Metacoceras dubium, Junction City.
Metacoceras Hayi, Junction City.
Metacoceras inconspicuum, Junction City.
Domatoceras umbilicatum, Oswego.
Asymptoceras Newloni, Oswego.
Phacoceras Dumbli, Junction City.

There are other specimens described by Professor Hyatt, but as they are not new we omit them.

Doctor Newlon's specimens are from carboniferous strata. The higher beds in Geary county, as I have remarked previously, I have called permo-carboniferous. Recently Professor Tchernyschew, of St. Petersburg, in company with Prof. H. S. Williams, of Cornell University, have made a short examination of the section exposed at Fort Riley, and, while agreeing that the lower beds are permo-carboniferous, they state that the upper beds — where the Phaceras is — are decidedly permian, the Russian professor assuring me that both faunal and lithologic characters can be duplicated in the permian of his own country. How this will affect the classification of Professor Hyatt I do not know, but in his report he treats all the specimens as carboniferous.

Professor Hyatt's descriptions are as follows:

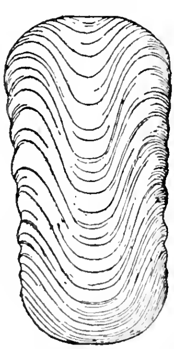

FIG. 3.

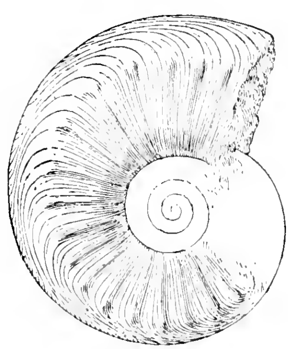

FIG 4.

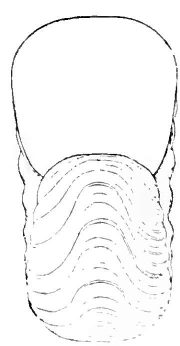

FIG. 5.

TEMNOCHEILUS CRASSUS, n. s.

Loc., near Oswego, Kas.
Carboniferous. Coll. National Museum.
Figs. 3, 4, and 5, magnified one-third.

This species is represented only by a fragment; but the characteristics are so peculiar that there is apparently little doubt of its being the representative of a distinct form.

The sides are convex and do not converge towards the umbilici so abruptly as in most forms of this genus. They are covered by numerous well-defined straight pilæ, terminating in small nodes at the edges of the abdomen. The abdomen is convex, with a narrow, slightly-depressed zone along the center. The shell is ornamented by prominent striæ of growth, and at regular intervals one of these is more prominent than the neighboring striations, showing frequent short arrests of growth. These striæ are straight upon the sides, but upon the abdomen bend suddenly posteriorly, forming wide sinuses of great depth; doubtless the aperture was similar. The sutures are almost straight on the sides and have a very broad and slight ventral lobe. Siphuncle unknown.

This shell is very similar to *Nautilus falcatus* L. de C. Sowerby, [see Prestwich, Geol. Coalbrookdale, Trans. Geol. Soc. London, V, pl. 40,] in so far as they both have ribs. The Coalbrookdale specimen, however, has no tubercles, or at least none are given, and the sides of the whorl are figured as concave. *Naut. Nikitini* Tzwetaev, [see *op. cit.*, pl. I. fig. 5,] is also very similar, but the ribs are less numerous and the sutures quite different. *Nikitini* has saddles and lobes as in *Tainoceras*. Living chambers were not observed. Position of siphuncle is unknown.

Figs. 3 and 4 show the fragment, and fig. 5 is therefore in part a restoration.

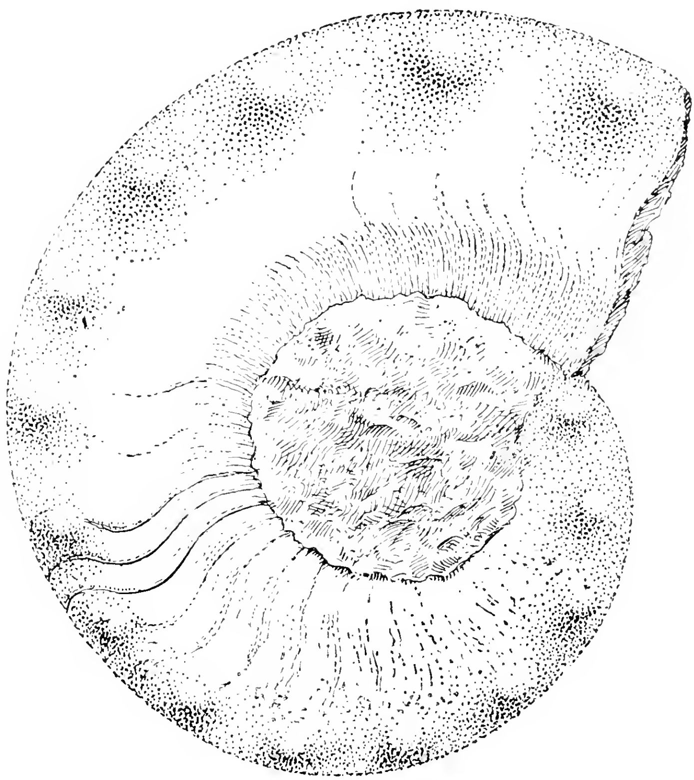

FIG. 6.

METACOCERAS DUBIUM, n. s.

Loc., Kansas. Coll. R. Hay.

Figs. 6 and 7, natural size.

There are no lines of abdominal tubercles, only low, broad, longitudinal swellings on either side of the depressed central zone of the abdomen, and the nodes on the sides are large and prominent, as in other species of this genus. The sides, however, are narrow and slightly concave, and internally a ridge is formed, on account of the suddenness with which they incline to the umbilicus at the dorsal shoulders.

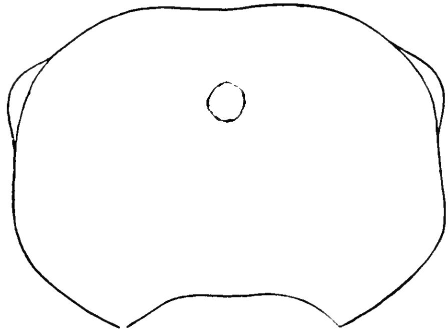

FIG. 7.

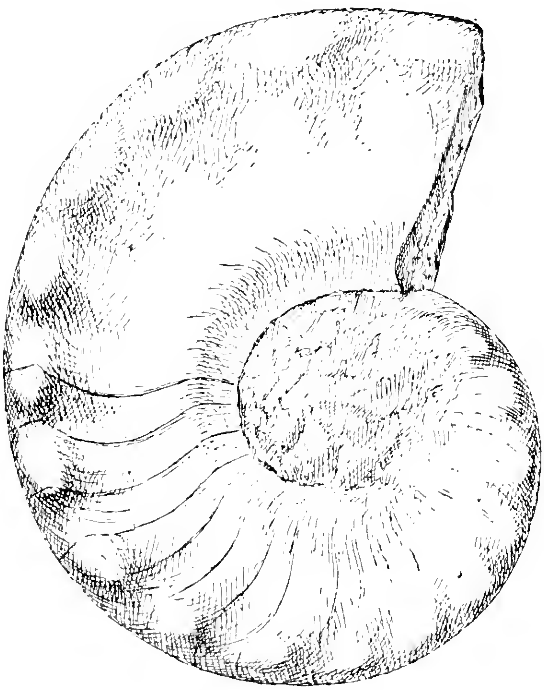

FIG. 8.

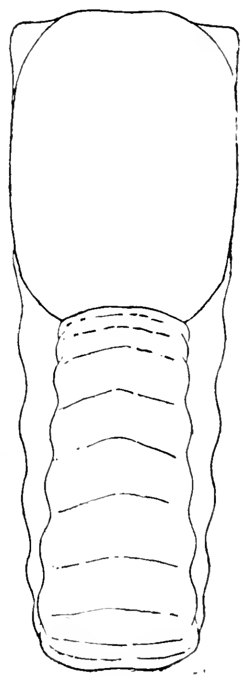

FIG. 9.

METACOCERAS HAYI, n. s.

Loc., Kansas. Coll. R. Hay.

Figs. 8 and 9, natural size.

This cast has broad, flattened sides, having angular, umbilical shoulders where the sides descend abruptly to the umbilici. There is an outer row of tubercles on the edge of the abdomen. These are elongated longitudinally, and the depressions between them are often very distinct; the surface of the cast is otherwise smooth. The sutures have short and very broad lateral lobes, with saddles at the umbilical shoulders and on the abrupt edges of the abdomen. The abdominal lobe is short and broad. It has a slight angle or V-shape in the specimen, but this is probably due to compression. The sutures just inside of the umbilical shoulders appear to be nearly straight on the nearly vertical narrow zones on either side of the outer whorl, but there is probably a shallow dorsal lobe on the impressed zone. The living chamber is about one-fourth of a volution in length, and still incomplete. The specimen is much narrowed by compression, and, making due allowance for this, the abdomen is slightly broader than the dorsum, measuring through the umbilical shoulders, and it has been so represented in the drawing. The amount of involution is slight, the whorls being in contact only along the surface of the slightly convex abdomen, and there is, consequently, only a shallow impressed zone in the dorsal surface of each whorl. Nevertheless, the increase by growth in the dorso-abdominal diameter of the whorl is evidently rapid.

Specimens of this and some other species were received through the courtesy of Capt. George E. Pond, of Fort Riley, Kas.

The front view (fig. 9) is in large part restored from a much-compressed specimen.

Its nearest ally occurs in the carboniferous in Russia. It differs from *Metacoceras* (*Nautilus*) *Tschernyschewi* Tzwetaev, [see Ceph. du Calc. Carbonifère de la Russie Centrale, Mém. du Com. Géol., V, No. 3, pl. 2, figs. 7–9.] in having somewhat broader sides and a narrower abdomen at the same age, and fewer tubercles. These also are elongated longitudinally, whereas in *Tschernyschewi* they are elongated transversely, forming a series of rib-like folds.

METACOCERAS INCONSPICUUM, n. s.

Loc., Kansas.

Coll. R. Hay.

Figs. 10 and 11, natural size.

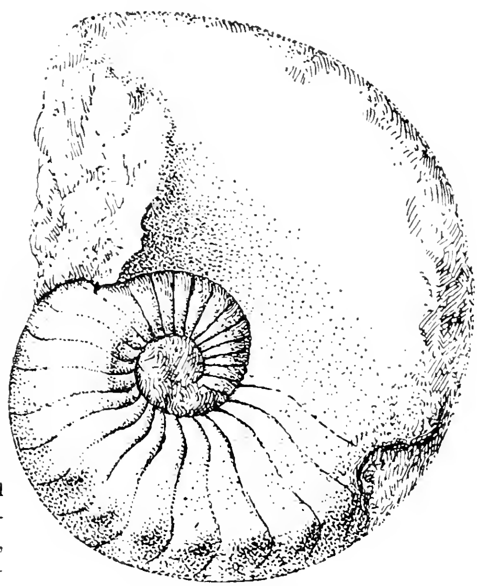

FIG. 10.

This cast has an aspect which at first sight leads one to think it is a species of *Tainoceras*, but the abdominal sutures are deficient in the pair of saddles distinguishing that genus, and there are no lines of abdominal tubercles. The whorl increases in abdomino-dorsal diameters faster than *Metacoceras cavatiformis*, but not in the transverse diameters; the whorl is, consequently, more compressed. The umbilical shoulders are not so angular as in that species, and the sides broader and less convergent outwards, and the tubercles upon the outer border of the sides are less conspicuous upon this cast. The sutures have about the same general contour as in the nearest ally just mentioned, but the lateral lobes are broader and shallower, and

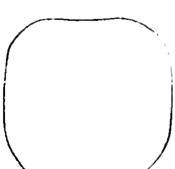

FIG. 11.

the saddles at the umbilical shoulders are not so prominent. The young do not seem to have the pilæ so plainly shown in the umbilicus of *Metac. cavatiformis*, but the cast may deceive the observer in this respect.

Fig. 11 represents a section of the adolescent whorl without tubercles.

DOMATOCERAS, n. g.

The species representing this genus is more closely allied to forms of *Centroceras* than to those of any other genus, but these, so far as known, have very peculiar and distinct characteristics. Although resembling this species in the external parts of the transverse section of the whorls and in the sutures, they differ in many ways. This is a true nautilan form, the impressed zone being a marked characteristic affecting the dorsal outlines of the sutures in this species, whereas the typical centroceran forms are gyroceran, having the impressed zone present only in the advanced stages of growth of some forms. The nealogic stages in Centroceras remain similar to the adults of Temnocheilus for a prolonged period, and the tubercles remain prominent, even on the casts throughout the later nealogic (adolescent) and earlier ephebolic (adult) stages. No tubercles were observed in *Domatoceras umbilicatum*, although it was sufficiently well preserved to have shown them had they existed. They might have been present in the earlier nealogic stages which were not visible. In Centroceras, the young whorl throughout the later nealogic stages is tetragonal, but the sides are divergent, the abdomen being broader than the dorsum. In this species, during the same stages, the sides are nearly parallel or only slightly convergent, and the abdomen nearly equal to or somewhat narrower than the dorsum.

Centroceras (*Temnocheilus*) *Scottense* (sp. Worthen, [see Geol. Surv. Ill., VIII, pl. 27, fig. 3]) is a good example of the genus Centroceras, having all the characteristic markings and forms of that genus.

DOMATOCERAS UMBILICATUM, n. s.

Loc., Oswego, Kas. Lower coal measures.

Coll. Nat. Mus., by Dr. Newlon.

Fig. 12, natural size of living chamber at first septum.

This species reaches a considerable size, the specimen here described being about 217 mm. in diameter.

The living chamber is incomplete, and is a trifle over one-fourth of a volution in length. The narrowing of the abdomen with increase of age is very marked on the living chamber in this specimen. It measures 192 mm. in length along the abdomen, 73 mm. in the abdomino-dorsal diameter at the last septum, and about 52 mm. in the transverse diameter at the umbilical shoulders, and 34 mm. near the venter. The sides of the whorls are flattened and converge outwardly, so that the abdomen is considerably less in breadth than the dorsum in the large, full-grown stage. There is a shallow, impressed zone upon the dorsum, which occupies about one-third of its width, and is due to the slight rotundity of the abdomen and the small amount of involution in the coiling of the whorls. The umbilical shoulders stand out abrupt and broad, giving a depth to the wide umbilicus, which is a marked characteristic. The sutures have shallow, ventral lateral lobes. The saddles at the umbilical shoulders are broad and extend inwards to the edges of the impressed zone, and then the sutures bend toward the apex, forming a shallow dorsal lobe. There are no annular lobes in the center of the dorsal sutures. The siphon is above the center, and is apparently nummuloidal. At the diameter of 95 mm., the whorl has the following measurements: Abdomino-dorsal diameter, 41 mm.; transverse through the umbilical shoulders, 32 mm., and breadth of the abdomen was 25 mm.

Domatoceras (*Nautilus*) *complanatum*, sp. Sow. Min. Conch., pl. 261, from Isle of

Man, from carboniferous, is another form of this genus, having a very slight form of involution, with a compressed whorl and subacute abdomen. The involution is very slight in this species, exposing all the internal whorls, but in the transverse section of the outer whorl, and in the sutures, it is unquestionably related to the species described above. The living chamber is over one-half of a volution in length, but it is not certain from the drawing that it is completed.

The species differs from (*Discites*) *highlandense* Meek and Worthen, [see Geol. Illinois, VI. p. 531, pl. 33, fig. 2,] in being much larger, in having stouter whorls. The sutures are, however, evidently very similar. *Highlandense* is described as having a narrow periphery, whereas this shell, when about the same size as the specimen figured in the Illinois survey, has an abdomen almost as broad as the dorsum, and very much broader proportionately than in its own adult whorl. It differs from (*Naut.*) *planovolve* Shumard, [see Trans. St. Louis Acad., I, p. 190,] in size, and in having whorls with more rapid growth, and probably a wider and deeper umbilicus than in that species.

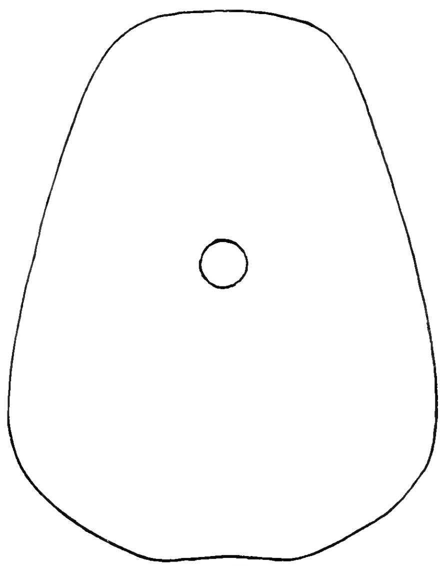

Fig. 12.

It differs from the nearest European congener *Kon. infundibulum*, as figured by De Koninck, [see Calc. Carb., pl. 24.] in having a narrower abdomen and a more compressed form of whorl in the adolescent and adult stages; also in the sutures, which have a more marked abdominal lobe. It differs from *Kon.* (*Nau-tilus*) *podolskensis* Marie Tzwetaev, [see Ceph. du Calc. Carb. de la Russie Centrale, pl. 3,] in the young. This is similar to the adult in the proportions of the parts, but in *K. podolskensis* the young whorl has an abdomen broader than the dorsum. The adult of this species also has a broader abdomen than the adult of our shell. The species evidently stands just between the genus represented by such species as *Kon. ingens*, *implicatum*, described by De Koninck, and *K. podolskensis*, all of which have stout whorls with broad abdomens, and whorls similar to those of the young of *K. umbilicatum*, and those species of the same genus having more contracted abdomens, like *mosquensis* (sp. Tzwetaev), *planotergatum* as figured by De Koninck, and *highlandense* (sp. M.and W.).

The last whorl was considerably altered by compression on one side.

Asymptoceras.

The *Cryptoceras Springeri* White and St. John, [see Trans. Chic. Acad., I, p. 124,] is the type of Meek's genus Solenocheilus, described in the "Invertebrate Paleontology," [see U. S. Geol. Surv. Terr., IX, p. 491,] and we quote from this volume the following: "The group for which Professor Worthen and the writer [Meek] used the name 'Solenocheilus' is almost entirely the same for which d'Orbigny proposed the name 'Cryptoceras' in 1850; but d'Orbigny's name cannot stand, because Barrande had used it for a genus of cephalopoda in 1846. It is true that Barrande subsequently changed the name of his genus to Ascoceras, because Latreille had, in 1804, used Cryptoceras for a genus of insects. If this was a sufficient reason, however, for changing Barrande's name, Latreille's Cryptoceras would be equally in the way of d'Orbigny's Cryptoceras; and if not, then Doctor Barrande's genus would have to retain his original name, which would render d'Orbigny's name equally untenable." *

In the Genera of Caphalopods I used the name of Ryckholt's Asymptoceras [see Notice sur le Asympt. et Vestin, 1852,] for this same group, of which the type was *Naut. cyclostomus* Phill. If Meek's reasoning holds good, it seems to us that both the names Cryptoceras and Solenocheilus should be dropped in favor of Asymptoceras. The whorls increase very rapidly in all their diameters, and the living chambers are correlatively short. The sides and venter are usually gibbous: the dorsum has either no impressed zone or only a very narrow zone of depression, showing how recent was the derivation of this group from the parent gyroceran forms. The siphon is so near the venter that it interrupts the suture in most species. So far as I have been able to see, however, it is to be noted that the edges of the suture do not bend backwards to form a siphonal lobe similar to that of an ammonoid. The siphon may become central in some adults, as in *Asympt. crassiventer*. The elliptical form of the young whorl, the large umbilical perforation, the simple, fine, smooth longitudinal ridges of the whorl in the young, and the presence of abrupt umbilical shoulders, indicate derivation from the open-whorled form. Aipoceras. The sutures have broad ventral, lateral and dorsal inflections or lobes, and small annular lobes.

The European species, so far as now known to me, are *Asympt. dorsale*, sp. Phill., *crassiventer*, sp. De Kon., *normale*, sp. De Kon., *latiseptatum*, sp. De Kon., *cyclostomum*, sp. Phill., and all of them are from the carboniferous. *Asympt. Springeri*, sp. White and St. John, *capax*, sp. Meek and Worthen, and the following, are all that are known to me in this country, all three being also carboniferous, coal measures.

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*NOTE.—The genus *Cryptoceras* was first described by d'Orbigny in his "Prod. Stratigraphique," (vol. I, p. 114.) *Naut. dorsalis* Phill. (Geol. Yorks., vol. II, pl. 17, fig. 17, pl. 18, figs. 1, 2) having been cited as the type. The name of the genus had, however, already been quoted on page 58 of the same volume, and *Naut. subtuberculatus* Sandb. mentioned below as a member of the genus. This species would, therefore, according to a very strict interpretation of the laws of priority, have to be considered the type. D'Orbigny, however, evidently meant his description on page 114, and the species there mentioned should be accepted, and considered the first mention on page 58 as a quotation.

I followed the first course in my Genera of Fossil Cephalopods (Proc. Bost. Soc. Nat. Hist., XXII, 1883, p. 283, and note, p. 297), reducing Cryptoceras, consequently, to a synonym of *Temnocheilus*. I brought together under this name, having *Tem. coronatus* McCoy (Syn. Carb. Foss. Ireland, pl. 4, fig. 15) as the type, all the nautiloids having ventral and dorsal lobes in their sutures, the siphon close to the venter, tuberculated shells, etc. There were, however, in reality, two groups of species included under this name in the essay alluded to, Asymptoceras in part and Temnocheilus as a whole. Temnocheilus should be limited to those species having discoidal whorls and open umbilici, in which the increase of the whorl by growth was slow along the abdomino-dorsal diameter, and much more rapid along the lateral or transverse diameter, especially near the angular junction of the sides and abdomen, the venter being, consequently, much broader than the dorsum, and the sides necessarily divergent, the umbilici deep. These also have large, blunt tubercles along the angular junctions of the sides and abdomen, and the sutures have broad ventral, lateral and dorsal lobes. The Devonian forms of Temnocheilus, so far as known, have no annular lobe in the center of the dorsal suture; but this is present in some carboniferous species, like *Tem. latus* De Kon. (Calc. Carb., pl. 24, fig. 2). The siphon, also, is near the venter in Devonian forms, but shifts nearer to the center in some carboniferous species, like *Tem. latus*. This organ, however, does not approach the periphery near enough to interrupt the line of suture on the venter in any species.

ASYMPTOCERAS NEWLONI, n. s.

Loc., Oswego, Kas. Coal measures.

Coll. Nat. Mus., Dr. Newlon.

The species in hand is a fragment very similar to *As.* (*Cryptoceras*) *capax* Meek and Worthen. [See Geol. Ill., VI, p. 532, pl. 33, fig. 1.] There are three air chambers incompletely preserved in the cast. The last two sutures are 17 mm. apart on the venter. The increase in size is very rapid, being as much as 46 mm. in the greatest transverse diameter, to 68 mm., a difference of 22 mm. in a distance of only 51 mm. as measured along the center of the venter, and only 35 mm. as measured along the side of the whorl.

These measurements show a more rapid increase than in the whorl of *Asympt. capax*. The sutures are not only wider apart than in that species, but the form of the whorl also differs. In the figure of *As. capax*, the greatest diameter of the living chamber is above or external to the umbilical shoulder, whereas in this species it is at the umbilical shoulder. The sides converge outwards from these shoulders and are not gibbous as in *capax;* and in the living chamber, which is evidently very nearly complete on one side, the whorl becomes flatter or more depressed on the abdomen than in *capax*, and the flaring of the aperture at the umbilical shoulders carries the lateral angles out with great rapidity. The diameter through the widest part of the whorl at the last suture is 68 mm., at a point about half way between this and the aperture about 82 mm., through the wings themselves not less than 120 mm., and perhaps a little more in perfect specimens.

The sutures have a distinct, but very shallow, broad lobe on the venter, which is irregularly interrupted by the siphon, and there are also shallow lateral lobes. In some specimens the sutures are very likely continuous, as they are in the figure of *capax*. If the side view of the sutures in the figure of *capax* is correct, these differ decidedly from those of this species. This shell differs from *Asym. Springeri* in having less angular umbilical shoulders, a more depressed abdomen, and more convergent sides. In fact, *Springeri* and *capax* resemble each other more than either of them resemble this species. [The species has been dedicated to Dr. W. S. Newlon, of Oswego, who found and sent the specimen, with some others described in this paper, to the National Museum.]

The comparative length of living chamber cannot be given, since the inner whorls were not visible.

PHACOCERAS DUMBLI, n. s.

Texas. Coll. Geol. Surv. of Texas.

Fort Riley, Kas. Coll. R. Hay.

The extraordinarily large size of this shell, its involute form, its compressed whorls, and the attenuated character of the outer part of the whorls in proportion to their transverse diameters, combined with the comparatively smooth and ribless shell, make this species interesting.

The umbilici are very narrow and small, the involution being almost complete. The increase of the vertical diameters by growth is extremely rapid, whereas the transverse diameters have increased very slowly, leaving whorls very much compressed or axe shaped. The broadest transverse diameters are near the umbilici, and from this part the whorl is slightly concave on both sides towards the periphery or abdomen. This, although very narrow, is flattened or slightly convex, even in the largest specimens.

The living chamber in one specimen was about one-half of a volution in length. The lines of growth indicate that the aperture probably had very broad lateral saddles and a single deep, narrow, median abdominal lobe.

The sutures are near each other, or slightly crowded in aspect. They have a narrow abdominal saddle, deep, broad lateral lobes, comparatively narrow lateral saddles near the umbilici, and a pair of shallow lateral lobes internally, on the shoulders of the whorls.

The shell is thin, and it is marked by fine lines of growth. The siphuncle is probably situated near the abdomen, but was not clearly seen.

A specimen sent me by Mr. Hay from Fort Riley is the most perfect specimen of this remarkable species that I have yet seen. It has an almost entire living chamber, about one-half of a volution in length, the sutures show well, and it is not as much compressed as specimens from Texas. All the specimens are reported as coming from carboniferous, as do all species of the genus so far found.

The sutures may have a slight lobe on the hollow of the narrow abdomen, where compression has affected them; where they are unaffected by compression, they are absolutely straight or very faintly concave. In Mr. Hay's cast, the outer part of the living chamber presents the abdomen as slightly convex, and leads one to think that the slight hollowness of the abdomen often present in younger whorls is due to compression. In fact, the whorl is broken along a line parellel with and near to the edge of the abdomen and is concave from compression on the right-hand (morphologically left) side until near the end of the living chamber. Here, where the abdomen presents a very flat convex surface, both sides of the whorl are unbroken and have the normal proportions.

This is the largest and finest species of the involute shells of this group yet found in the carboniferous. The principal differences between it and *Nautilus Rouilleri*, the adult of which was described and figured by Trautschold [see Kalbruche von Miatschkowo, p. 28, pl. 3, fig. 7,] under the name of *oxystomus*, [the name *Rouilleri* was given to this as the type in De Koninck's Calcaire Carbonifére, p. 124, in his description of *Nautilus oxystomus*, which last was afterwards taken by the writer as the type of his genus Phacoceras, in "Genera of Fossil Cephalopods," Proc. Bost. Soc. Nat. Hist., XXII, 1883, p. 292,] and the young by Marie Tzwetaev, [see *op. cit.*, p. 53, pl. 6, figs. 33 and 34,] consist in its size. The principal difference between the European and American is that the former retains throughout life —that is to say, on all parts of its largest whorl, which is much larger than that of the European species—the peculiar but flattened abdomen which is found only in the young of *Phacoceras Rouilleri*. This character is of genetic importance, and, together with the longitudinal ridges and form of the young in this species, and in *P. oxystomum*, show that these acute involute shells were derived by descent from more discoidal shells, like those of the genus Discitoceras. This also serves the purpose of explaining the occurrence in the carboniferous of their apparently anachronic forms and structural characteristics. The aspect of the adults and the sutures in this genus are like triassic species, such as *Grypoceras* (*Nautilus*) *galeatus* Mojsisovics, and at first they appear to have occurred before their proper geologic period. When, however, their young are studied, it is plain that their shells at early stages have the ordinary characteristics of normal members of the carboniferous faunas, and that the peculiarities of later stages were evolved from purely carboniferous forms. Their mimicry of triassic shells in later stages must therefore be regarded simply as good examples of parallel progressive complications arising independently in different genetic series during different periods of time. In *Rouilleri* the flattened aspect of the crest of the abdomen is retained much longer in the course of the growth than in *Phacoceras oxystomum*. The American species, with its truncated abdomen existing in the adult, is therefore the most immature form of the group yet discovered, and although it is as yet impossible to come to any conclusion, this fact at present points to the fauna of this country at the place of origin or aldainic fauna of this series. *Rouilleri* is probably genetically connected with *P. Dumbli*, or some equivalent species, and *P. oxystomum* is similarly connected with *P. Rouilleri*. In both of these, however, it is superseded in the subsequent stages of shell growth by an acute abdomen.

NOTE.—I find from correspondence with Professor Hyatt, (April 25, 1893,) that he has ascertained that the genus *Phacoceras* is distinct from the group to which *dumbli* ought to be referred, and he will give another generic name in his forthcoming report on carboniferous cephalapods, to be printed in the next Annual Texas Report.

THE FORMATION OF DONIPHAN LAKE, IN THE SPRING AND EARLY SUMMER OF 1891.

BY E. B. KNERR, ATCHISON.

Though the formation of narrow lakes by rivers leaving their old courses and cutting new channels in times of freshet is by no means unusual, yet in the case of large rivers, such as the Missouri, these formations are never without some interesting features.

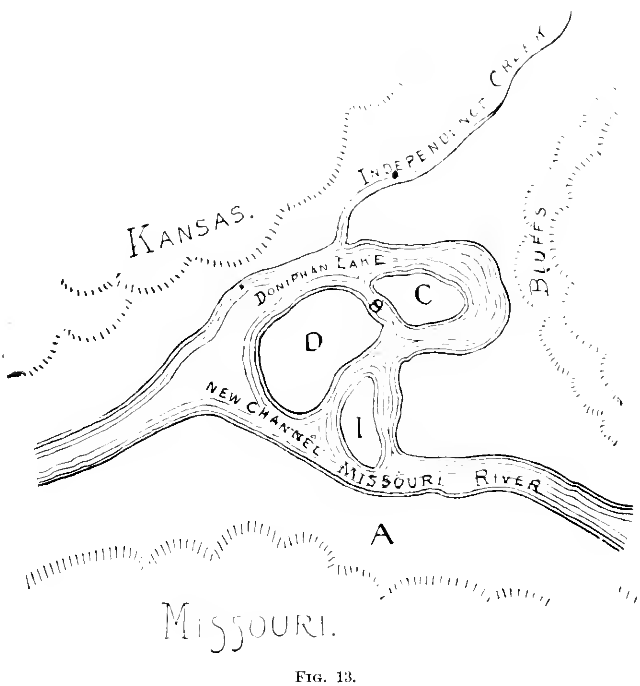


FIG. 13.

Prior to the present year, the Missouri river made quite a detour some five miles north of Atchison, about a point known as "Doniphan point," and each year it kept extending the bend further northward, encroaching quite rapidly upon the site of what was once the thriving little town of Doniphan. Time and again new roads had to be cut further in from the river. But during the early rises of the present year a great change took place which has, for generations at least, dispelled all fears of further encroachments, and which may eventually make of old Doniphan something of a pleasure resort.

By the map, it will be seen that as the river came southward it made a sharp turn toward the west, at *A*, dividing into two branches which soon united, encircling what was known as "The Island" (*I*). The last June rise was unusual for this locality, and the upper branch of the river soon broke over the "point," at *B*, thus forming the first cut-off. But it was not long until the lower portion overflowed the bottoms directly south of it, taking a straight course across the neck and joining the main channel below. Thus, two additional islands, *C* and *D*, were formed, and the old channel to the north of them remained filled with water and constituting the so-called lake. This lake is about four miles in length and, in places, a half to three-fourths of a mile wide. A number of soundings, taken October 9, showed depths varying from 10 to 18 feet. Deposits of sand and mud have about closed up both ends of the lake, but the southern end can never become completely closed, as Independence creek enters about a mile from this end, and will furnish more or less current, especially in time of freshet, thus tending to keep the channel open.

SELECTIVE ABSORTION OF HEAT BY LEAVES.

BY A. G. MAYER, LAWRENCE.

In this research, it was necessary that the thermopile measure with precision down to thousanths of degrees of temperature; it was, therefore, important to cut off all air currents.

The thermopile was incased in two tin boxes, the one outside the other, leaving an air space inclosed by tin all around the instrument; a suitable opening, which could be closed at will with a screen impervious to radiant heat, allowed the heat to fall directly upon the thermopile when desired.

By allowing heat from any source to fall directly upon the thermopile, and then obliging it to pass through a leaf placed in its path, it became possible to determine the effect of the leaf upon the radiant heat.

Experiments were made upon a great many leaves and petals of flowers, and the results were surprisingly alike. As an example, we will cite the case of elm leaves. A single elm leaf in the path of the heat allows only 23.5 per cent. of the radiant heat to pass through it; so 76.5 per cent. is absorbed by the leaf. If now the heat, which has already passed through one leaf, be allowed to pass through a second, we find that the second absorbs only 21.4 per cent. and transmits 78.6 per cent., showing plainly a remarkable selective absorption. A third leaf in the path allows 83 per cent. of the heat which passed through the second leaf to pass through unabsorbed. The transmitting powers of leaves varies from 17.6 to 28.3 per cent. The lower number is for the thick leaves of the mullen, and the higher represents the transmitting power of rose leaves. The transmitting power of various flower petals was as follows: Red rose, 31.2 to 33.3 per cent.; yellow rose, 23.9 per cent.; white rose, 26.6 per cent.; white petals of *Œnothera speciosa*, 26.6 per cent.; petals of purple grass, 30.8 per cent.

Leaves are, therefore, good absorbers of heat, but bodies which are good absorbers are good radiators. The radiation from leaves is about 78, lampblack being 100. We see, then, that were the leaves to radiate their heat at night at this rapid rate they would soon lose much of the energy which they received from the sun during the day. The research has, however, developed the remarkable fact that when leaves become covered with dew the radiation is the same for all, being that of a dew surface, and is much less than the radiation of naked leaves, being only 62.7 per cent. of lampblacked surfaces. This is one of the causes that has contributed in no small degree to make coal so abundant upon the earth.

NESTING OF THE PIED-BILLED GREBE.

BY A. M. COLLETTE, EMPORIA.

The pied-billed grebe (*Podilymbus podiceps*) is known to every boy who ever shouldered a gun and wandered along our creeks and rivers by some of the following names: Thick-billed grebe, Carolina grebe, dabchick, dipper, water-witch, devil-diver, or hell-diver.

It is a common summer resident in our State, and very abundant in migration, arriving the last of April and remaining until late in the fall.

These birds (like all the family) are noted for their wonderful power of diving and swimming. I think it would be safe to say that in a minute's time they can dive 300 or 400 feet.

Colonel Goss, in his "History of the Birds of Kansas," says: "Some writers hold that these birds do not use their wings under water. This may be so; but I am inclined to think, when out of the rushes and with nothing to catch or tangle, they use them to accelerate their speed."

They do not often take to wing, relying more on their power of swimming and diving as a means of escape; and it is almost impossible to force them to leave the water, but when in the air, fly with great rapidity, with neck and feet stretched out to their full extent.

About their breeding places they are very shy, and, when approached, will cover their eggs and slip quietly away, thus leading a great many ornithologists to believe that these birds do not occupy their nests during the day, but cover them with decaying vegetation and the eggs are kept warm by the artificial heat from this material.

The doubt that existed in my mind with regard to this has been entirely eradicated. A good opportunity offered itself this summer to watch their nidification and I took advantage of it.

On a large pond, about three miles from Emporia, covered with rushes and other aquatic plants, these birds are found in great abundance. They were first observed nesting here by V. L. Kellogg, of the State University, in 1885, at which time he procured a number of sets. It might be interesting to add that they have never nested here since until this summer, when I took about 20 nests.

The nests are composed of decaying reeds, rushes, and grass, mixed with a debris brought up from the bottom. This structure is fastened to the flags and reeds, making a floating island of decaying material a few inches above the water, upon which a small nest is built.

Two of the nests that I found were located in some small aquatic plants a short distance from the bank, in about three feet of water, and from a tree on the bank the eggs could be distinctly seen.

From this tree I could watch the birds without being seen by them, and during all the time I watched them I never saw them leave the nest unless disturbed, and then they would always quickly cover their eggs, glide under the water without a ripple, come up at a sufficient distance from me, and make a kind of cackling noise, but would soon return by diving and coming up among the weeds, near the nest, as soon as alone.

Mr. O. Davie, author of "Nests and Eggs of N. A. Birds," claims that the birds cover the eggs during the day and sit on them during the night, never going near the nest in the daytime. Mr. Geo. Cantrell says that he has noticed that where the sets are complete, the eggs are covered with vegetable matter and incomplete sets are found uncovered, and the deeper the eggs are imbedded in the refuse matter the more incubated they are, a fresh set just having a thin layer over them. He accounts for this by saying the layer first put on loses its heat after a time and more is put on to keep up the necessary heat. He gives this merely as a theory which will not stand, as facts are what we want.

Mr. William Smith, observing their nesting in Colorado, says that he took a number of sets that retained their natural color, owing to the nest being built of living grass, although plenty of decaying material was close at hand. This alone would upset the decaying theory. The habit of covering the eggs while off the nest is for the purpose of concealing them from their common enemy, such as hawks, etc., and not for the artificial heat from the decaying vegetation.

They begin laying about May 10. The number of eggs laid by this species ranges from 3 to 10—the complement is usually five. The eggs, when fresh, are white, with a slight bluish shade, but soon become stained in their wet bed. A nest of 10, in the collection at the State Normal, measure: 1.75x1.20, 1.87x1.21, 1.80x120, 1.76x1.21, 1.78x1.22, 1.80x1.22, 1.83x1.23, 1.80x1.20, 1.76x1.22, 1.74x1.20, but the average size is 1.72x1.17.

LIST OF PLANTS COLLECTED BY THE GARFIELD UNIVERSITY EXPEDITION OF 1889.

BY M. A. CARLETON, MANHATTAN.

The plants named in this list were collected in the summer of 1889 by a party sent out by the Garfield University, composed of the following persons: N. D. Laughlin, C. C. Willson, Robert Rogers, and the writer, in charge. Most of the species were obtained in the Rocky Mountain region, from Colorado to the head waters of the Missouri river, but a few were collected on the plains of eastern Colorado.

For aid in the identification of species, I am very much indebted to Pres. J. M. Coulter, of Indiana State University, who named a great majority of them. Prof. L. H. Bailey named the carices, and Prof. W. A. Kellerman and W. T. Swingle identified some of the fungi. Other species I have determined myself. The species are arranged in their natural orders—the phanerogams according to Luerssen and sufficient citations given to facilitate references to their descriptions, with the addition of occasional notes of interest. When no citations are given, descriptions are readily found in Coulter's "Manual of Rocky Mountain Botany."

Specimens of all the species, with possibly three or four exceptions, are to be found in the Garfield University herbarium, and in my own herbarium. Many of them are also in the herbaria of the Kansas Agricultural College and Indiana State University.

All the specimens from Limon, Colo. (a station on the Rock Island railroad about 150 miles from the east line of the State), were collected in the first week of

July; those from Manitou, Pike's Peak, and Salida, Colo., were collected during the first half of July; those from Salt Lake City and Wasatch mountains, in the latter part of July; the Montana species, during the first part of August; and the species from Idaho and Yellowstone Park, in the latter part of August.

CRYPTOGAMIA.

Erysipheæ.

Erysiphe communis (Wallr.) Fr. Sacc. Syll. Fung., I, p. 18. On leaves of Ranunculus sceleratus. Helena, Mont.

Hyalosphoræ.

Physalospora megastoma (Pk.) Sacc. Sacc. Syll. Fung., I, 437. Bot. Gaz. IV, 231. On leaves of Astragalus flexuosus. Limon, Colo.

Uredineæ.

Puccinia gentianæ (Strauss) Lk. I, II, III. Sacc. Syll. Fung., VII. p. 604. On leaves of Gentiana (Parryi?). Beaver Cañon, Idaho.

Puccinia tanaceti, DC. Sacc. Syll. Fung. VII, p. 637. II on leaves of Cnicus undulatus. Limon, Colo. (Some spores of Darluca filum were found on the same host.) II, III, on leaves of Artemisia tridentata (sage-brush). Beaver Cañon, Idaho.

Æcidium clematidis, DC. Sacc. Syll. Fung., VII, p. 774. On Clematis ligusticifolia, "Gate of the Mountains." Missouri river, Mont.

Æcidium ranunculacearum, DC. Sacc. Syll. Fung., VII, p. 776. On leaves of Ranunuculus cymbalaria. Limon, Colo.

Uredo oxytropidis Pk. Sacc. Syll. Fung., VII, p. 855, Bot. Gaz. 1879, p. 218. On leaves of Oxytropis lamberti. Salida, Colo.

Uredo speciosa Pk. Sacc. Syll. Fung., VII, p. 860, Bot. Gaz. 1878, p. 34 (Lecythea) On leaves of Rubus deliciosus. Manitou Springs, Colo.

Exoasceæ.

Taphrina extensa (Pk.) Sacc. Sacc. Syll. Eung., VIII, p. 815 (=Ascomyces extensus Pk., N. Y. State Mus. Rep. 39, p. 50). On leaves of Quercus.

Equisetaceæ.

Equisetum pratense Ehrh. Beaver Cañon, Idaho.

Filices.

Woodsia scopulina Eaton. "Crystal Park," on Cameron's Cone trail, Manitou, Colo.; also at Upper Yellowstone Falls, Yellowstone Park.

Pteris aquilina L. Abundant and of strong growth in Gibbon Cañon, Yellowstone Park.

Cheilanthes fendleri Hook. "Crystal Park," on Cameron's Cone trail, Manitou, Colo.

PHANEROGAMIA.

Coniferæ.

Pinus edulis Eng. "Piñion," or "Nut-pine," Manitou and Salida, Colo.

Abies concolor Lindl. Manitou, Colo.

Juniperus virginiana L. Manitou, Colo., and Salida, Colo.

Naiadaceæ.

Potamogeton pusillus L.? Salt Lake City, Utah.

Cyperaceæ.

Carex alpina Swartz. Manitou, Colo. ("Crystal Park.")

Carex aurea Nutt. Salida, Colo.

Carex filiformis L. var. latifolia Boeckl. Salida, Colo.

Carex tenella Schk. "Crystal Park," Manitou, Colo.

Carex utriculata Boott. Salida, Colo.

Carex variabilis Bailey. Studies of the Types of Various Species of the Genus Carex, p. 18; Memoirs Torr. Bot. Club, I, No. 1 (Carex stricta Lam. and C. aperta Boott. var. divaricata Bailey, of Coulter's Manual, p. 385, ed. 1885). Salida, Colo.

Gramineæ.

Agropyrum glaucum R. & S. Salida, Colo., Helena, Mont.

Phragmites communis Trin. "Gate of the Mountains," Missouri river, Mont.

Commelynaceæ.

Tradescantia virginica L. Colorado Springs, Colo.

Juncaceæ.

Juncus tenuis Willd. Salida, Colo.

Liliaceæ.

Calochortus gunnisoni Wats. Manitou, Colo.

Lloydia serotina Reich. Pike's Peak trail, Colo.

Allium cernuum Roth. Salida, Colo.

Iridaceæ.

Iris missouriensis Nutt. Manitou, Colo.

Orchidaceæ.

Spiranthes romazoffiana Cham. Beaver Cañon, Idaho.

Cupuliferæ.

Betula occidentalis Hook. Western or "Black Birch," Manitou Springs, Colo.

Salicaceæ.

Salix amygdaloides Anders. (?) Salida, Colo.

Salix flavescens Nutt. Salida, Colo., and Manitou, Colo.

Urticaceæ.

Urtica breweri Wats. Manitou, Colo.

Urtica holosericea Nutt. Salt Lake City, Utah ("City Creek Cañon").

Polygonaceæ.

Rumex maritimus L. Helena, Mont.

Polygonum bistorta L. Manitou, Colo.

Eriogonum brevicaule Nutt. "City Creek Cañon," Salt Lake City.

Eriogonum corymbosum Benth. Pike's Peak trail, Colo.

Eriogonum flavum Nutt. A bright yellow-flowered species. Pike's Peak trail.

Eriogonum microthecum Nutt. Salida, Colo.

Nyctaginaceæ.

Abronia fragrans Nutt. Manitou, Colo.

Abronia sp. Salida, Colo.

Oxybaphus angustifolius Sweet. Manitou, Colo.

Oxybaphus hirsutus Sweet. Manitou, Colo.

Caryophyllaceæ.

Arenaria fendleri Gr. Pike's Peak trail.

Arenaria stricta Wats. Pike's Peak trail.

Stellaria longipes Goldie. Pike's Peak trail.

Cerastium arvense L. Pike's Peak trail.

Saponaria vaccaria L. (Gray's Man., p. 83). Manitou, Colo.

Paronychia jamesii T. & G. Pike's Peak trail.

Paronychia sessiliflora Nutt. "Gate of the Mountains." Missouri river, Mont.

Portulacaceæ.

Claytonia chamissonis Esch. Pike's Peak trail, at considerable elevation.

Ranunculaceæ.

Aquilegia chrysantha Gr. Manitou, Colo.

Aquilegia cœrulea James. A very beautiful columbine, growing abundantly in shady cañons about Manitou Springs.

Caltha leptosepala DC. Pike's Peak trail, above 10,000 feet altitude.

Ranunculus aquatilis L., var. trichophyllus Gr. Helena, Mont., Salida, Colo.

Ranunculus cymbalaria Ph. Marshes, Limon, Colo.

Ranunculus sceleratus L. Wet grounds, near Helena, Mont.

Thalictrum fendleri Engelm. Manitou Springs, Colo.

Clematis alpina Mill., var. occidentalis Gr. Pike's Peak trail, at 8,000 to 10,000 feet altitude.

Clematis ligusticifolia Nutt. "Gate of the Mountains," Montana, and Manitou, Colo.

Papaveraceæ.

Argemone platyceras Link & Otto. Limon, Colo.

Fumariaceæ.

Corydalis aurea Willd., var. occidentalis Gr. Manitou, Colo.

Cruciferæ.

Lepidium intermedium Gr. Salida, Colo.

Erysimum asperum DC., var. arkansanum Gr. Manitou, Colo.

Thelypodium integrifolium Endl. "City Creek Cañon," Wasatch mountains, at Salt Lake City, Utah.

Draba streptocarpa Gr. Pike's Peak trail, above 10,000 feet altitude, and above "timber line."

Nasturtium officinale R. Br. "City Creek Cañon," at Salt Lake City, and near Helena, Mont.; mentioned in Coulter's Man., in note at bottom of p. 24 (1885); now common throughout the "Rockies."

Nasturtium palustre DC. Helena, Mont.

Capparidaceæ.

Cleome integrifolia Torr. & Gr. Salida, Colo.

Cleomella angustifolia Torr. Helena, Mont.

Malvaceæ.

Sida hederacea L. See Coulter's Manual Phan. & Pterid. Westn. Tex., p. 39 (vol. II, No. 1, Contrib. U. S. Nat. Herb.) Not given in Coulter's Man. Rocky Mt. Bot., ed. 1885. Salt Lake City, Utah.

Sphæralcea rivularis Torr. & Gr. Beaver Cañon, Idaho.

Malvastrum coccineum Gr. Manitou and Littleton, in Colorado.

Malvastrum sp.? Salida, Colo.

Sidalcea malvæflora Gr. Salida, Colo.

Geraniaceæ.

Geranium maculatum L. Manitou Springs, Colo.

Linaceæ.

Linum perenne L. Helena. Mont., and Salida. Colo.
Linum rigidum Ph. Helena, Mont.

Sapindaceæ.

Acer glabrum Torr. Trail to "Cameron's Cone," near Manitou. Colo.

Euphorbiaceæ.

Euphorbia montana Engelm. Manitou, Colo.

Umbelliferæ.

Aletes acaulis C. & R. Coulter & Rose, Revis. N. Am. Umbell. p. 126 (=*Carum?* hallii Wats. of Coulter's Manual). Pike's Peak trail, Colo.

Oreoxis humilis Raf. Coulter & Rose, Revis. N. Am. Umbell. p. 89. Not given in Coulter's Manual, ed. 1885. Pike's Peak trail, at 12,000 ft. alt. "High Mountains of Colorado, at 11,000 ft. alt. and upward," (Coulter & Rose, l. c.).

Ligusticum sp.? Manitou, Colo.

Cornaceæ.

Cornus stolonifera Mx. Beaver Cañon, Idaho.

Crassulaceæ.

Sedum stenopetalum Ph. Manitou, Colo.

Saxifragaceæ.

Ribes floridum L'Her. "Gate of the Mountains." Upper Missouri river, Mont.
Jamesia americana Torr. & Gr. Trail to Cameron's Cone, near Manitou, Colo.
Parnassia fimbriata Banks. Beaver Cañon, Idaho.
Parnassia parviflora, DC. Salida, Colo.
Heuchera hallii Gr. Manitou, Colo.
Saxifraga bronchialis L. Trail to Cameron's Cone.
Saxifraga nivalis L. Pike's Peak trail, at 8,000 to 11,000 ft. alt.

Loasaceæ.

Mentzelia multiflora Gr. Manitou, Colo.
Mentzelia pumila Torr. & Gr. Manitou, Colo.

Onagraceæ.

Gaura coccinea Nutt. Helena, Mont.
Œnothera albicaulis Nutt. Limon, Colo.
Œnothera cæspitosa Nutt. Manitou, Colo.
Œnothera coronopifolia Torr. & Gr. Salida, Colo.
Œnothera sinuata L. Manitou, Colo.

Gayophytum ramosissimum Torr. & Gr. Snake River, Idaho, on stage line between Beaver Cañon and Yellowstone Park.

Epilobium coloratum Muhl. Salt Lake City, Utah, and Helena. Mont. A much-dwarfed form was also found at Helena.

Epilobium spicatum Lam. Manitou, Colo.

Halorageæ.

Hippuris vulgaris L. Salida, Colo.

Rosaceæ.

Rosa arkansana Porter. Manitou, Colo.
Potentilla anserina L. Salida, Colo.

Potentilla fruticosa L. Manitou, Colo., and Beaver Cañon, Idaho. A very common species in the Rocky Mountain region.

Potentilla glandulosa Lindl. Manitou, Colo.

Potentilla hippiana, Lehm. Cameron's Cone trail, Colo.

Potentilla rivalis Nutt., var. millegrana Wats. Helena, Mont.

Fragaria vesca L. Manitou, Colo., and Yellowstone National Park.

Geum rossii Seringe. Pike's Peak trail, at 10,000 to 12,000 ft. alt.

Rubus deliciosus James. Cameron's Cone trail, near Manitou, Colo.

Spiræa discolor Ph. var. dumosa Wats. Coulter, Phan. & Pterid. West. Tex., Polypetalæ, p. 104. (= Holodiscus discolor Maxim., var. dumosa Maxim., of Coulter's Man. Rocky Mt. Bot.) Trail to Cameron's Cone, Manitou, Colo.

Physocarpus monogyna Coult. Man. Phan. & Pterid. W. Tex., Polypet., p. 104. (P. Torreyi Maxim. of Man. Rocky Mt. Bot., ed. 1885). Manitou, Colo.

Leguminosæ.

Sophora sericea Nutt. Limon, Colo.

Vicia americana Muhl. Manitou, Colo.

Oxytropis lamberti Ph. Salida, Colo.

Astragalus hypoglottis L. Helena, Mont.

Astragalus flexuosus Dougl. Limon, Colo.

Astragalus multiflorus Gr. Limon, Colo.

Astragalus pectinatus Dougl. Limon, Colo.

Astragalus pictus Gr., var. filifolius Gr. Limon, Colo. Peculiar for its filiform leaves, together with large, brilliantly-mottled fruit.

Astragalus racemosus Ph. Limon, Colo.

Petalostemon macrostachys Torr. Limon, Colo.

Psoralea lanceolata Nutt. Limon, Colo.

Trifolium involucratum Willd. Salida, Colo.

Lupinus argenteus Ph. Limon, Colo., Cameron's Cone trail, Colo., and Beaver Cañon, Idaho.

Lupinus pusillus Ph. Limon, Colo.

Thermopsis rhombifolia Richardson. Salida, Colo.

Primulaceæ.

Douglasia arctica Hook. Syn. Flora, vol. II, part I, p. 59. Not given in Coulter's Manual (ed. 1885). Heretofore, "known only from our northwestern Arctic sea shores, and poorly known, even from that locality." (Coulter.) The Synoptical Flora gives but three species of this genus, and one only, Douglasia montana Gr., from the United States (Montana and Wyoming); while D. arctica Hook. is stated as occurring on the "Arctic sea shore, between the Mackenzie and the copper mine," on the authority of Richardson. Its range is now extended into Colorado. Found on Pike's Peak trail, at 12,000 ft. alt., and upward.

Primula angustifolia Torr. Pike's Peak trail, at 12,000 ft. alt.

Dodecatheon meadia L. Manitou, Colo.

Polemoniaceæ.

Polemonium humile Willd. Manitou, Colo.

Gilia aggregata Spreng. Manitou, Colo.

Gilia iberidifolia Benth. Limon, Colo.

Gilia pinnatifida Nutt. Limon, Colo.

Hydrophyllaceæ.

Phacelia sericea Gr. Pike's Peak trail, Colo.

Boraginaceæ.

Lithospermum canescens Lehm. Manitou, Colo.

Mertensia alpina Don. Abundant on Pike's Peak trail, at 12,000 ft. alt.

Mertensia oblongifolia Don. Pike's Peak trail, Colo.

Mertensia paniculata Don. Pike's Peak trail, Colo.

Krynitzkia jamesii Gr. Limon and Manitou Springs, Colo.

Krynitzkia virgata Gr. Manitou, Colo.

Omphalodes nana Gr., var. arctioides Gr. Pike's Peak trail, at 12,000 ft. alt.

Solanaceæ.

Nicotiana attenuata Torr. Beaver Cañon, Idaho, along the Utah & Northern R. R.

Physalis lobata Torr. Limon, Colo.

Solanum triflorum Nutt. Helena, Mont.

Scrophulariaceæ.

Pedicularis canadensis L. Pike's Peak trail, Colo.

Pedicularis procera Gr. Manitou, Colo.

Castilleia miniata Dougl. Manitou, Colo.

Castilleia pallida Kunth., var. septentrionalis Gr. Cameron's Cone trail, Manitou, Colo.

Veronica americana Schw. Helena, Mont., and Salida, Colo.

Synthyris plantaginea Benth. Manitou, Colo.

Mimulus luteus L. Beaver Cañon, Idaho, and City Creek Cañon, Wasatch mountains.

Pentstemon acuminatus Dougl. Manitou, Colo.

Pentstemon barbatus Nutt. Trail to Cameron's Cone, Manitou, Colo.

Pentstemon glaber Ph. Manitou, Colo.

Pentstemon glaucus Graham. Manitou, Colo.

Pentstemon gracilis Nutt. Manitou, Colo.

Pentstemon watsoni Gr. Manitou, Colo.

Labiatæ.

Stachys palustris L. Salida, Colo.

Scutellaria galericulata L. Helena, Mont.

Nepeta cataria L. Salt Lake City, Utah, and Helena, Mont.

Mentha canadensis L. Salida, Colo.

Var. glabra Benth. Salida, Colo., and Helena, Mont.

Verbenaceæ.

Verbena bracteosa Mx. Littleton, Colo. (a station on Denver & Rio Grande R. R., between Denver and Pueblo).

Gentianaceæ.

Frasera speciosa Dougl. High on the mountains, at Manitou, Colo.

Gentiana parryi Engelm. Beaver Cañon, Idaho.

Apocynaceæ.

Apocynum androsæmifolium L. Manitou and Salida, in Colorado, and Salt Lake City, Utah.

Asclepiadaceæ.

Asclepias verticillata L., var. pumila Gr. Littleton, Colo.

Campanulaceæ.

Campanula aparinoides Ph. Helena, Mont.

Campanula rotundifolia L. Manitou, Colo.

Campanula uniflora L. Salida, Colo.

Rubiaceæ.

Galium boreale L. Manitou, Colo.

Caprifoliaceæ.

Lonicera involucrata Banks. Salida, Colo.

Compositæ.

Lygodesmia juncea Don. Helena, Mont.

Lactúca pulchella DC. Salida, Colo.

Troximon glaucum Nutt. Manitou, Colo.

Cnicus altissimus Willd. var. discolor G. (?) Helena, Mont.

Cnicus ochrocentrus Gr. Limon, Colo.

Senecio eremophilus Richardson. Manitou, Colo.

Senecio douglasii DC. Salida, Colo., and Limon, Colo.

Senecio fendleri Gr. Salida, Colo.

Senecio serra Hook. Beaver Cañon, Idaho.

Artemisia tridentata Nutt. "Sagebrush," Beaver Cañon, Idaho.

Artemisia wrightii Gr. Salida, Colo.

Crepis runcinata Torr. & Gr. Limon, Colo. Extends the range of this species considerably eastward.

Hymenatherum aureum Gr. Limon, Colo.

Actinella grandiflora Torr. & Gr. Pike's Peak trail, Colo., at 12,000 ft. alt. The very large, yellow flower heads make this a brilliant and conspicuous species for alpine regions, where there is usually a remarkable absence of yellow flowers.

Actinella richardsoni Nutt. Salida, Colo., and Manitou, Colo.

Actinella scaposa Nutt. Manitou, Colo.

Helenium autumnale L. Helena, Mont.

Bahia oppositifolia Nutt. Limon, Colo.

Hymenopappus filifolius Hook. Limon, Colo.

Coreopsis lanceolata L., var. villosa Mx. Syn. Flora, vol. I, part II, p. 292; Gray's Man., p. 282. Manitou, Colo.

Helianthus pumilus Nutt. Manitou, Colo.

Gymnolomia multiflora Benth. & Hook. Littleton, Colo., and Salt Lake City· Utah.

Rudbeckia hirta L. Salida and Manitou, Colo.

Rudbeckia laciniata L. Salida, Colo.

Iva ciliata Willd. Helena, Mont.

Iva xanthiifolia Nutt. Helena, Mont.

Gnaphalium sprengelii Hook. & Arn. Manitou, Colo.

Erigeron canadensis L. Salida, Colo.

Erigeron divaricatus Mx. Helena, Mont.

Erigeron flagellaris Gr. Manitou, Colo.

Erigeron glabellus Nutt. Manitou, Colo.

Erigeron pumilus Nutt. Helena, Mont.

Aster adscendens Lindl. Salida, Colo.

Aster commutatus G. Helena, Mont.

Townsendia grandiflora Nutt. Manitou, Colo.

Solidago canadensis L., var. procera Torr. & Gr. Beaver Cañon, Idaho.

Solidago missouriensis Nutt., var. montana Gr. Helena, Mont.

Solidago serotina Ait. Salt Lake City, Utah.

Aplopappus integrifolius T. C. Porter. Helena, Mont.

Chrysopsis villosa Nutt. Manitou, Colo.

Grindelia squarrosa Dunal. Salt Lake City, Utah.

Liatris punctata Hook. Helena, Mont.

AN ASTRONOMICAL LANTERN.

BY E. B. KNERR, MIDLAND COLLEGE, ATCHISON.

We all remember how unsatisfactory were our first attempts to trace the positions of the several constellations in the heavens, and then, after we had found them for ourselves, how difficult it was to point out the stars to others and feel quite sure that our friends were looking at the ones we desired them to see.

The object of the lantern here presented is to obviate this difficulty, and enable one to locate the constellations and principal stars in a little while by means of an illuminated map.

The lantern consists of a box of suitable size, *i. e.*, about 10 inches high by eight wide and six deep, made of light wood or tin on all sides, except the front, where it should be so constructed that a glass plate 8 by 10 inches may be inserted. The top and bottom of the box should have numerous perforations, to admit of air for a candle or lamp employed on the interior to illuminate the map. The map should be made of stiff white paper, the positions of the stars marked by ink, and the stars of different magnitude properly distinguished. Fine ink lines should connect the several stars of each constellation and the name of the group should be printed near by in small, distinct letters. The map should be circular in form, seven inches in diameter, with the center corresponding to the zenith, and the circumference to the horizon. The glass plate in front of the lantern should have a hole about one-eighth inch in diameter bored through its center, through which a wooden key may pass. To this key the map should be fastened at its center on the inner side of the glass, in such a way that it will revolve when the key is turned. One such map for each month of the year should be constructed, representing the appearance of the heavens at about 9 o'clock in the evening. These maps may be copied from published charts. The north, east, south and west margins should be properly marked.

If now, for example, it is desired to study the constellations in the north, the proper map for the season of the year should be fitted to the interior of the lantern and turned about by means of the key at the center, until the edge marked "north" is lowest down. The observer then faces the north with the lantern resting or held directly before him, remembering that the center of his map represents the zenith and the lowest part the northern horizon. Then will the stars of the northern heavens occupy positions corresponding exactly with those marked on the lower half of his map and they may be recognized with the utmost ease.

Should he now desire to study the eastern heavens, he faces the east and turns the map by the little key until the limb marked "east" is downmost, and again he has an exact picture of the sky before him; and thus with all parts of the heavens in turn.

PROBABLE TEMPERATURE OF THE SUMMER IN LAWRENCE, KAS.

BY E. C. MURPHY, LAWRENCE, KAS.

Probably most of us have heard the remark that, if the winter is mild the summer will be cool, and if the winter is cold the summer will be hot. The basis of this saying is, of course, the fact that the mean annual temperature of any place is quite nearly constant. If the mean annual temperature were exactly constant, then, if there is a deficiency of temperature during a part of the year, there must be an excess of the same amount of temperature during the remaining part.

It is the object of this investigation to determine, from Prof. F. H. Snow's temperature record for Lawrence, the degree of certainty with which we may predict the temperature of the summer vacation at that place. To those of us who go to the mountains and various other places, to escape the hot weather of July and August, this subject is of interest.

The three summer months, June, July, and August, form the third quarter of the year. It will serve best our purpose to have the summer the last quarter. The summer will then be at the end of our year, and we can thus better predict its temperature. We have, therefore, divided the record so as to have the first of September the beginning of each year. The annual temperatures computed from this division do not differ much from those computed with the year beginning on the 1st of January.

YEARS. Sept. 1 to Aug. 31.	*Means—Sept. 1 to Aug. 31....*	*Means—Sept. 1 to May 31....*	*Means—June 1 to Aug. 31....*	*Variations—Sept. 1 to Aug. 31....*	*Variations—Sept. 1 to May 31....*	*Variations—June 1 to Aug. 31....*
1868-'69	50.43	42.62	73.86	−2.47	−2.74	−1.62*
1869-'70	52.09	44.53	74.76	−.81	−.83	−.72
1870-'71	54.93	47.79	76.36	+2.03	+2.43	+.88
1871-'72	51.81	43.57	76.52	−1.09	−1.79	+1.04
1872-'73	50.68	41.88	77.06	−2.22	−3.48	+1.58
1873-'74	53.52	44.43	80.80	+.62	−.93	+5.32
1874-'75	50.39	42.24	74.87	−2.51	−3.12	−.61
1875-'76	53.96	46.78	75.51	+1.06	+1.42	+.03
1876-'77	52.01	44.76	73.75	−.89	−.60	−1.73
1877-'78	56.39	50.15	75.13	+3.49	+5.21	−.35
1878-'79	54.32	47.08	76.05	+1.42	+1.72	+.57
1879-'80	55.82	49.45	74.92	+2.92	+4.09	−.56
1880-'81	51.66	42.41	79.41	−1.24	−2.95	+3.93
1881-'82	55.62	49.85	72.91	+2.72	+4.49	−2.57
1882-'83	52.45	45.54	73.20	−.45	+.18	−2.28
1883-'84	51.25	43.99	73.05	−1.65	−1.37	−2.43*
1884-'85	51.08	43.34	74.28	−1.82	−2.02	−1.20*
1885-'86	52.71	44.69	76.80	−.19	−.67	+1.32
1886-'87	53.56	46.15	75.77	+.56	+.79	+.29
1887-'88	52.04	44.33	75.18	−.86	−1.03	−.30
1888-'89	53.02	46.25	73.31	+.12	+.89	−2.17
1889-'90	54.05	46.37	77.10	+1.15	+1.01	+1.62*
1890-'91	52.36	45.91	71.74	−.54	+.55	−3.74
	52.90	45.36	75.48			

The numbers in columns 1, 2, 3 and 4 need no explanation. Any number in column 5 is gotten by subtracting the number opposite to it in column 2 from the mean at the foot of column 2. The numbers in columns 6 and 7 are gotten from those in columns 3 and 4, in the same way that the numbers in column 5 are gotten from those in column 2. A plus variation means temperature above the mean or normal, and minus variation means temperature below the normal.

Examining the numbers in columns 6 and 7, and comparing those for the same year with each other, we see that there are 12 with like signs and 11 with unlike signs. We see that of these 12 with like signs four only are such that both the numbers are greater than .88°. Of these four numbers, after each of which I have placed a star, three have minus signs and one a plus sign. Remembering that variations with like signs in columns 6 and 7 signify a failure to predict correctly the summer temperature, we see that in the 23 years covered by this record about one-half the predictions in regard to whether the summer temperature will be above or below the normal would fail. Of these 12 failures, four only are bad failures (*i. e.*, temperature more than .88° above or below the normal). Of these four bad failures, three are in predicting a hot summer, which was cool. There has been only one summer in the 23 years in which one would have predicted a cool summer which proved to be a hot one.

SEVEN-YEAR PERIODICITY IN RAINFALL.

BY E. C. MURPHY, LAWRENCE.

In my paper answering the question, "Is the rainfall in Kansas increasing?" I have divided the rainfall record of Fort Leavenworth and Manhattan into seven-year wet and seven-year dry periods. It is the object of this investigation to determine to what extent the rainfall records of other places in the United States and Canada may be thus divided.

For this purpose, I have used the 11 longest and most nearly continuous rainfall records in United States and Canada. These records each cover a period of from 40 to 76 years, and from 6 to 10 seven-year periods.

The records down to 1875 are taken from vol. 24 of the "Smithsonian Contributions to Knowledge." The records from 1875 to 1890 are signal-service records, sent me by the chief signal officer.

The method of investigation is: (1) Plat the record or curve of annual rainfall; (2) study the curve, and from its appearance divide it into seven-year periods; (3) find the mean of each period. In nearly every case, it is easy to see from the curve how to divide the record, or where to begin the division of the record, so that when the means of the periods are found they will be, approximately, alternately wet and dry.

Each curve has been studied by itself, without any reference to other curves. I have tried, in each case, to find the most natural division into seven-year periods, without regard to whether the periods at the different places begin with the same year. The accompanying chart shows these curves platted to scale in the usual way, and the division into periods, and the means of the periods.

Table No. 1 shows the years in the periods, the means of the periods, and whether wet or dry.

TABLE No. 1.—Seven-year periodicity in rainfall.

New Bedford, Mass.		Philadelphia, Pa.		Providence, R. I.		Boston, Mass.		Leavenworth, Kas.		Rochester, N. Y.	
Years.	*Means.*	*Years.*	*Means.*	*Years.*	*Means.*	*Years.*	*Means.*	*Years.*	*Means.*	*Years.*	*Means.*
1819–'25	39.84 D	....	....	....	....	....	....	....	....	....	....
1826–'32	50.45 W	1826–'32	38.86 D	....	....	....	....	....	....	....	....
1833–'39	38.03 D	1833–'39	41.28 W	1832–'38	36.29 D	....	....	....	....	....	....
1840–'46	39.78 W	1840–'46	40.99 D	1839–'45	40.61 W	1823–'29	40.42 D	1836–'42	30.43 D	1837–'43	30.29 D
1847–'53	40.93 D	1847–'53	43.59 W	1846–'52	41.27 D	1830–'36	41.59 W	1843–'49	32.03 W	1844–'50	33.96 W
1854–'60	40.79 W	1854–'60	44.69 D	1853–'59	45.10 W	1851–'57	44.82 D	1850–'56	31.16 D	1851–'57	32.35 D
1861–'67	42.68 D	1861–'67	45.91 W	1860–'66	44.94 D	1858–'64	53.78 W	1857–'63	33.82 W	1858–'64	34.73 W
1868–'74	49.67 W	1868–'74	49.26 D	1867–'73	49.65 W	1865–'71	44.89 D	1864–'70	34.03 D	1865–'71	36.65 D
1875–'81	42.23 D	1875–'81	39.03 W	1874–'80	49.98 D	1872–'78	51.37 W	1871–'77	43.16 W	1872–'78	39.30 W
1882–'88	47.63 W	1882–'88	38.15 D	1881–'87	50.65 W	1879–'85	44.89 D	1878–'84	37.89 D	1879–'85	33.24 D

Toronto, Can.		St. Louis, Mo.		Marietta, Ohio.		Cincinnati, Ohio.		Muscatine, Iowa.		Steubenville, Ohio.	
Years.	*Means.*	*Years.*	*Means.*	*Years.*	*Means.*	*Years.*	*Means.*	*Years.*	*Means.*	*Years.*	*Means.*
1838–'44	38.91 W	1840–'46	40.83 D	1830–'36	41.91 W	1835–'41	44.39 D	....	....	....	....
1845–'51	33.30 D	1847–'53	48.43 W	1837–'43	39.77 D	1842–'48	50.18 W	1847–'53	50.74 W	....	....
1852–'58	35.20 W	1854–'60	47.52 D	1844–'50	40.93 W	1856–'62	38.76 D	1854–'60	35.87 D	1836–'42	34.39 D
1859–'65	34.13 D	1861–'67	41.13 W	1851–'57	38.75 D	1863–'69	40.35 W	1861–'67	36.61 W	1843–'49	46.46 W
1866–'72	35.39 W	1868–'74	36.43 D	1858–'64	44.66 W	1870–'76	39.54 D	1868–'74	34.80 D	1850–'56	38.68 D
1873–'79	31.63 D	1875–'81	38.63 W	1879–'85	39.36 D	1877–'83	47.75 W	1875–'81	41.50 W	1857–'63	45.93 W
1880–'86	31.14 W	1882–'88	41.47 D	1886–'92	48.05 W	1884–'90	36.16 D	1882–'88	38.69 D	1864–'71	43.02 D

TABLE No. 2.—Seven-year periodicity in rainfall.

PLACE.	*Length of record.*	*Omissions—years.*	*No. periods.*	*Failures.*	*One-half failures.*
New Bedford, Mass.	1814–'90	0	10	2	1
Philadelphia, Pa.	1824–'90	0	9	1	3
Providence, R. I.	1832–'90	0	8	0	2
Boston, Mass.	1818–'90	9	7	0	0
Leavenworth, Kas.	1836–'90	1	7	0	1
Rochester, N. Y.	1831–'90	1	7	0	1
Toronto, Can.	1840–'90	0	7	0	1
St. Louis, Mo.	1837–'90	0	7	0	2
Marietta, Ohio	1826–'90	7	7	0	0
Cincinnati, Ohio	1835–'90	3	7	0	1
Muscatine, Iowa	1846–'90	0	6	0	0
Total			82	3	12

Table No. 2 gives the results of the investigation. Column 1 gives the name of the place where the observations were taken; column 2, the date of the beginning and ending of the record; column 3, the number of years of the record in which observations were not taken; column 4, the number of seven-year periods in the record; column 5, the number of whole failures; and column 6, the number of half failures.

To illustrate what we mean by a failure and a half failure, take three of the Fort Leavenworth means, viz., 33.82, 34.03, and 43.16. The second of these is greater than the first, and is therefore wet with respect to the first; but it is less than the third, and hence is dry with respect to the third. This is a half failure. If the second mean were greater than the first and third, when it should be less than both, it would be a failure.

Examining Table No. 2, we see that there are only three failures and 12 half failures in the 82 seven-year periods of these 11 places.

THE TWENTY-FIFTH ANNUAL MEETING.

PROCEEDINGS.

The Kansas Academy of Science met in its twenty-fifth annual session, at Atchison, on October 12, 13. and 14, 1892. The following extracts are taken from the minutes of the Secretary:

A business meeting was held in the parlors of the Hotel Byram, and the usual committees were appointed.

The Treasurer's report was read and accepted.

On Wednesday evening, the address of the retiring President, Prof. E. A. Popenoe, was delivered.

The annual election of officers resulted in the following choice:

President—E. H. S. Bailey.

First Vice President—J. T. Willard

Second Vice President—E. B. Knerr.

Secretary—A. M. Collette.

Treasurer—D. S. Kelly.

Librarian—B. B. Smyth.

Curators—A. H. Thompson, B. B. Smyth, Chas. S. Prosser.

On Friday evening, the Sphynx Club, of Atchison, tendered a banquet to the visiting members.

At this meeting, 18 new members were voted in.

It was voted to hold the next meeting, in the fall of 1893, at Emporia.

On the following pages will be found papers read at this meeting.

IN MEMORIAM—JOSEPH SAVAGE.

BY ROBERT HAY.

Since our last meeting, the Academy has lost by death one of its oldest and most useful members. Joseph Savage died on the 30th of December, 1891. He was 68 years old, having been born at Hartford, Vt., July 28, 1823. His father, William Savage, was born in 1791, so these two lives exactly span a century. Joseph Savage was connected with the family which produced General Hazen, of the Signal Service, his mother, whose maiden name was Polly Hazen, born in 1799, being a cousin of the General.

In 1847, Joseph Savage married Amanda B. Crandall, who was his wife for 10 years and the mother of his five children. Filled with New England ideas of freedom, he came to help make Kansas a free Territory and a free State. He came to Lawrence in the fall of 1854. He went back, directly, and brought his wife and family in the spring of 1855. He paid $500 for a squatter's claim, and also the Government preëmption price, for a quarter section of land, which is now the northwest quarter of section 12, township 13, range 19 east. It was a piece of wild prairie, without tree or shrub, or other shelter than a sod house. He lived on it to his death. It has now a comfortable stone house, noble avenues and groups of trees, and rich orchards. Our friend was one of those who made the desert bloom: his farm has brought forth much fruit. His wife, three years his junior, succumbed to the wild conditions of Kansas in the '50s. She died and was buried on the farm in 1857. He had a loving heart; companionship was a necessity to him, and a mother was needed in his house. He went back to New England, and at Springfield, Mass., on April 14, 1858, Joseph Savage was married to Mary Burgess, and brought her to Kansas. She still lives on the homestead which their joint labors have made so beautiful. All but one of his children died in childhood. The survivor, a daughter, has long been the wife of Mr. Alford, an attorney of Lawrence, and the voices of grandchildren have added to the pleasures of the Savage homestead. In the place of his dead children, there was an adopted daughter, who married and became Mrs. Martin, about a year before Mr. Savage's death.

Of the dangers during the Kansas war, of the imminent risks of the Quantrill raid, when he was saved only by hiding in the corn, while his wife encountered the raiders alone — of these and such events we will not speak here.

He was a close friend of Charles Robinson, but was not himself a leader. He upheld the hands of those who did lead. He was, religiously, a Congregationalist. Since the days of Oliver Cromwell and Sir Harry Vane, Congregationalism has gone with the support of civil liberty. Doctor Cordley has told how, when the first Congregational society was organized among the Free-State men of Lawrence, Joseph Savage held the candle while the clerk wrote the names. The incident is suggestive of his whole life. He has often held the candle to encourage those who have been working for truth — truth religious, truth social, or truth scientific.

After the war, peace. For Joseph Savage, work. The physical work has made a mark on the topography of Douglas county. The moral and intellectual forces he exerted are much wider spread; they go beyond the State of Kansas; they reach to the stars.

There was one thing, especially, Joseph Savage believed in — education. In three forms of educational work in Kansas he was especially interested: The common school of his district, a noted one in Douglas county, he made a center of intellectual life. For many winters, courses of lectures have been given there by men of State reputation. Then, at the top of the educational column, the University, his near neighbor, was a sort of pet of his. When he was abroad in the State, he said a good word for the University; and its professors and students and societies were frequent guests on his farm. He spoke of the students as *our* boys, or *our* girls. Men devoted to science were very welcome — botanists, entomologists, geologists, have ofttimes been visitors for days and weeks. About 1866 or 1867, he was with Professor Mudge exploring western Kansas.

In 1870, the third annual meeting of the Kansas Natural History Society was held at Lawrence. My honored friend, John Fraser, Chancellor of the State University, was president of the society, and, in a felicitous speech, he proposed for membership the names of Joseph and Mary Savage. There was an appropriateness in the incidents in which our friend took a part. Joseph Savage had not had a collegiate or any scientific training, but he had worked himself into considerable attainments as a geologist, and was a member of Doctor Hayden's party in the exploration of the Yellowstone Park. John Fraser was Scotch, so was Mrs. Savage, who was the first lady member of the Academy.

John Fraser was a personal friend of Hugh Miller. The subject of the evening lecture at the meeting was "Hugh Miller." The lecturer was John Barrows. He and

John D. Parker, one of the founders of the Society, were guests at the Savage home during the meeting. At that meeting the Society changed its name; it became US: the Kansas Academy of Science. Since then (21 years), Joseph and Mary Savage have given to this Society much service and more of good will. At the eighth annual meeting, Joseph Savage became secretary, and he was reëlected next year. At the eleventh meeting, 1879, he was chosen vice president, and to this office he was re-elected the next year, which was the last meeting at which Professor Mudge presided. At the thirteenth meeting, he became first vice president. It fell to his lot to be of the committee to prepare resolutions of respect for the memory of John Fraser, and also that of Professor Bardwell. He was also the principal worker with Prof. I. T. Goodnow in procuring funds with which the Mudge monument was erected, under the auspices of the Academy, at Manhattan.

Mr. Savage also served the Academy as a member of the geological "commission," when our work was divided among committees so named.

Besides serving the Academy thus officially, he for many years took a full share in the meetings, preparing and reading numerous papers, which, if not technical, as some of those of his associates, were always full of information, and had a strong human interest. I do not think the following is a complete list, but it will serve to show that he was not an idle friend of the Academy:

1. An Account of the Journey up the Yellowstone, with photographic illustrations, at Manhattan.
2. On the Bite of a Rattlesnake.
3. On the Remains of Mastodons in Douglas County.
4. Mounds in Southern Kansas, 1879.
5. Sink Holes in Wabaunsee County, 1879.
6. Concretionary Forms, 1880.
7. Stone Implements in Trego County, 1880.
8. The Agate Beds of Trego County, 1881.
9. The Leavenworth Coal Mines, 1881.
10. Report of the Committee on the Mudge Monument, then completed, 1882.
11. Some Lightning Freaks, 1883.
12. Observations on the Habits of Ants.
13. The Christening of Amethyst Mountain, 1884.
14. The Geology of Spanish Peaks, 1884
15. A Geological Paper, 1885.
16. The Pink and White Terraces of New Zealand, 1886.
17. The Fossil Bone Bed in Garden Park, 1887.

Besides these descriptive or scientific papers, he made many little speeches at our evening reunions and banquets. He had a singularly happy way of saying something pleasant and serious, and a short, happy laugh, when recognizing something good in the work of other members, as he often did. One of these speeches the writer remembers showing his grateful religious disposition. He said he often thought of the superintending kindness of God in creation, preparing pleasure as well as profit for man in the things of nature, taking it as a personal kindness to himself when digging out some fine fossil, that God had laid up that pleasure for him. If there was any jealousy in him, it was for his favorite science; he was always anxious that attention should be given to it. He was as pleased with the work and enthusiasm of others as with what he had done himself.

Some years ago his health began to fail, and he was hurt by a fall from his buggy. He missed several of our meetings, but was present in 1890, and at the banquet responded to the toast of the "Old Members." His wife says of that speech: "He spoke in a very touching and beautiful way, and I was very proud of him." And she had a right. We too are proud that Joseph Savage honored this society by 20 years of membership, service, and sympathy.

The Douglas County Horticultural Society had in Mr. Savage an active member, and to this society he read useful papers, notably one in December, 1877, on the soils of eastern Kansas, with the loess of the eastern counties as his principal illustration. In this paper he pointed out that the loess was especially good for strawberry growth, and that, as with its namesake in the Rhineland, it is the proper home of the grape vine. On the other hand, he showed that pear blight was developed among the trees of the loess.

There are many personal reminiscences we might give, but this is not the place. We want to record our appreciation of our departed friend while he was with us, and to express our sympathy with his bereaved partner, who says in a recent communication that he "was laid away on New Year's day, 1892. A happy new year to him, and the saddest and loneliest that ever came to me." May it be hers and ours to have a glad reunion.

E. P. WEST.

BY S. W. WILLISTON.

Judge E. P. West was born in Simpson county, Kentucky, November 14, 1820. His early years were spent upon a farm, and the greater part of his education was obtained at the Russellville Academy. He came to Cass county, Missouri, when 20 years of age, and there devoted himself to the study of law, shortly afterward entering upon its practice. For 30 years he was engaged in the practice of his profession, serving meanwhile as the judge of the court of common pleas of Cass county, and, during the Buchanan administration, as United States district attorney for New Mexico, his commission having been signed by Daniel Webster. During the War of the Rebellion, he was captain in the Missouri State Guards.

About 1870, he removed with his family to Kansas City, Mo., and practiced his profession there successfully for several years. He then began to turn his attention toward scientific subjects, especially geology and archæology. He was one of the founders of the Kansas City Academy of Science, and, for a while, in conjunction with Mrs. Judge Krekel, edited a monthly magazine devoted to scientific subjects. His patient examination of the works of the mound builders along the Missouri river, attracted much attention. About eight years before his death, he became connected with the Kansas University, a position which he held uninterruptedly to the day of his death, which occurred January 26, 1892, from heart failure, in conjunction with ills incident to old age.

Personally Mr. West was, in many respects, a man of remarkable character, with a tireless energy and an indomitable will. At an age when most men are content to lean upon others, he still asserted, in an undiminished degree, the self-reliance and independence which had always characterized him. When past 70 years of age, he spent a season in the fossil fields of western Kansas, camping out alone, under the blazing sun and severe storms. Mr. West never published much. A few papers in the proceedings of this Academy, and in the Kansas City *Record of Science*, are about all, but he has left an unimperishable monument in the results of his tireless and patient labor in the geological department of the State University. To him, more than to any one else, is due the credit of the building up of the collection of fossils of the State in the museum of the University, a collection unequaled elsewhere, and one of which the State may be justly proud.

As is always the case with men of such strong will as he possessed, he was not always understood, his marked peculiarities often concealing his real worth. Beneath his exterior, so often brusque, he had a kind heart. Especially was he averse to all ceremony and pretension, and singularly opposed to anything which tended to make him personally prominent.

His last illness was long and painful, though undergone without complaint; he only wished for death. Almost the last words, found among his papers, were the following: "I have passed a pleasant day, and the night has overtaken me by the wayside. Let me rest in its kind enfoldments."

ON THE IMPROVEMENT OF SORGHUM BY SEED SELECTION.

BY G. H. FAILYER AND J. T. WILLARD, STATE AGRICULTURAL COLLEGE.

The experiments reported upon are those conducted by the chemical department of the Agricultural College Experiment Station. The full accounts of this work, which extends over five years, may be found in the reports and bulletins of the station. The work may be briefly outlined, as follows:

1. The object of the experiment is to improve our best varieties of sorghum by propagating only from the best stalks.

2. Which are the best stalks is determined in the only way possible, viz., by analysis of the juice of single stalks. In this way the most superior seed tops from among several hundred single plants can be selected.

3. Seed from the best seed tops so obtained is planted the next year, and selections are again made as before, and so on year after year.

4. A large, but gradual, increase in sugar content has been observed during the five years that the experiment has been in progress. Part of this improvement may be due to acclimatization, but the writers think that no reasonable doubt can be entertained that the seed selection has been a very important factor in the improvement.

A VARIETY OF AMPELOPSIS QUINQUEFOLIA.

BY E. B. KNERR, ATCHISON.

So far as I have been able to ascertain, the botanies fail to notice and describe a variety of the Virginia creeper, *Ampelopsis quinquefolia* Michx., in which characteristic points of difference from the typical species are quite marked.

In the first place, the habit of growth is quite different. As is commonly known, the true species climbs by clinging very closely to its support, whether that be a tree or a wall. The variety does not cling so closely to its support; in fact, it is impossible for it to climb a wall or a tree trunk, unless the bark of the tree be very rough, owing to the structure of its tendrils. It climbs rather like the grape and the clematis, by trailing over low shrubbery to that which is higher, until it may reach the lower branches of a tree, when it may rise to a considerable height by reaching from branch to branch, rather than by clinging close to the body of the tree and larger branches. Sometimes, in transplanting the Virginia creeper, this variety is hit upon, and people wonder why it fails to cling to the side of the house. If the tendrils be examined, they will be found to be more like grape tendrils, long, curling, and grasping by recurved tips, rather than short, digitate, and clinging by disk-like expansions, as in the case of the typical species. The leaves also differ quite perceptibly, being much larger for the same age in the variation, and having larger petioles, both for the leaf proper and for the leaflets. The margins are more strongly serrate, tending to double serrate. The internodes of the stem are much longer in the variety, causing the leaves to be fewer and more scattered. The nodes are more swollen, as are the leaf petioles at the base, making a much larger leaf scar, but the axillary buds are smaller. The stem of the type species is quite rough, furrowed, and warty, especially as it grows older, while the variety is much smoother. The fruit of the variety is more abundant, berries larger, and in more open corymbs.

In short, the whole aspect of the variety is more grape-like, and for this reason we suggest the name *A. quinquefolia*, var. *vitacea*.

NOTES ON "MOUNTAIN LEATHER," FROM RED ROCK CAÑON, COLORADO.

BY E. B. KNERR.

The red sandstone of the Red Rock Cañon, Colorado, along the Colorado Midland railroad, is extensively quarried for building purposes. In the seams and joints of this rock may be found a tenacious asbestos or paper-like mineral, known as "mountain leather." When the seam is large, allowing of a thicker deposit, the mineral is rather spongy, and is then known as "mountain cork." An analysis of the mineral gave the composition as follows:

SiO_2	59.02
Al_2O_3	8.51
MgO	9.57
K_2O	.81
Na_2O	4.28
H_2O	18.21
	100.40

RECENT ADVANCES IN THE STUDY OF THE NERVOUS SYSTEM.

BY C. JUDSON HERRICK, OTTAWA.

The past decade has been a period of unparalleled activity in the study of the nervous system, both human and comparative. Investigation has appreciated more and more the value of the latter method. The points mentioned in this brief review are almost all the direct outgrowths of improved histological and embryological methods.

One of the most valuable results of these studies has been the establishment of safe homologies through the entire series of vertebrates, from the fish to man. The commissures have naturally received especial attention. The callosum, formerly supposed to belong exclusively to the higher mammals, has, in recent years, been found by various observers in the kangaroo, a few birds, serpents, and batrachians. About two years ago, it was found by my brother in the alligator,* and by him last year in the opossum, strongly developed.† Last winter, in working up material col-

*Notes on the Brain of the Alligator, by C. L. Herrick, Journal of Cincinnati Society of Natural History, 1890.

†Journal of Comparative Neurology, February, 1892.

lected by us from the Ohio river the summer previous, he found unmistakable evidences of a callosum in the bony fishes. Our best morphologists have hitherto been unanimous in describing the fish brain as lacking the callosum. The common drum, *Haploidonotus*, however, has this commissure well developed.* My friend, Mr. C. H Turner, has also found the callosum in several groups of birds, where its presence had not hitherto been suspected.† The other great commissures of the brain have been studied with results quite as satisfactory. If space permitted, we might dwell on the philosophical significance of these facts; suffice it to say, that the homologizing of the commissures of the brain is a long step in the direction of a solution of the vexed question of the segmentation, or metamerism, of the head—a step, too which once surely taken, might lead directly to that solution.

The so-called "pineal gland" has been the subject of active discussion from the day that Spinoza declared it to be the seat of the soul until now. Here, too, the comparative method has borne good fruit. Whatever its present function, (and there are nearly as many opinions here as there are authors,) its origin seems clear. It is present in all vertebrates, and in the lower is more perfectly developed than in the higher. Moreover, it is larger and more perfectly developed in the young than in the adult. These points show that its significance is to be sought in the past rather than the present. It is now several years since the bold suggestion was hazarded that it formerly functioned as an eye. Of this, the evidence grows yearly more conclusive. Alborn, on petromyzon,‡ Herrick, on the lizard and black snake,§ and many others, find evidence of a degenerate retinal surface in the pineal body, while Ritter, in a paper on "The Parietal Eye in Some Lizards from the Western United States," describes‖ a pigmented retinal epithelium in the pineal body, and in the same vesicle a rudimentary lens and other evidences of the so-called parietal eye. Appearing at almost the same time in the *American Journal of Science*, (February, 1891,) is Professor Marsh's description of the skulls of certain North American fossil reptiles, the Dinosaurs, with a large "parietal foramen," an opening in the top of the head at the union of the parietal and squamosal bones. This he regards as the socket of a "pineal eye."

In the fishes there is great modification of the relations. The compact, conical body of the mammals is represented by a very slender tube, with walls consisting of a single layer of epithelium. This tube passes up toward the top of the cranium, which, however, we are told it never reaches.¶ Whatever may be the relations in the adult teleostean brain, they are certainly not as described in the case of the young. I have sections of a young catfish one inch long, cut through the entire body, which show this tube very clearly passing up to the skull and spreading out to form a closed sac, which I have no hesitation in saying is the rudiment of a primitive optic vesicle. The skull, too, at this point is considerably thinner than in the adjacent regions.

Of supreme importance in all matters which concern the origin of nerve cell and nerve fiber, is a recent paper, by Prof. Wm. His, on "Histogenesis and Combination of Nervous Elements."** The nervous system, at an early embryonic stage, consists of a simple tube, running the entire length of the body, with walls of single-layered columnar epithelium. This relation persists in the adult, and is the basis of the

* Ibid., December, 1891.

† Ibid, March, 1891.

‡ Zeits. f. Wiss. Zoölogie, XXXIX.

§ Jour. Comp. Neurology, I, pp. 27, 28.

‖ Bull. Mus. Comp. Zoölogy, January, 1891.

¶ Wiedersheim's Comparative Anatomy, Eng. tr., p. 142; and, in the case of the catfish, by Professor Wright, in the Proceedings of the Canadian Institute, vol. II, p. 363.

** Histogenese und Zusammenhang der Nerven-Elemente, Archiv. f. Anat. und Phys., 1890.

connective tissue framework of the brain. These cells shrink and collapse in the center; but in lower brains, at least, our sections seem to show that they retain their continuity from the ventricular to the outer surface of the brain and cord. Between these cells (spongioblasts) there appear, according to Professor His, at an early stage, isolated nuclei, probably derived from the nuclei of the spongioblasts. These so-called neuroblasts have remarkable powers of motion, and migrate, sometimes in large numbers, to adjacent parts of the brain or spinal cord, as the case may be. From these neuroblasts are derived all nerve cells and fibers; from the spongioblasts, the connective tissue elements of the brain. In a subsequent paper, on the development of the human spinal cord, Professor His applies these principles in detail, tracing the origin of the various nuclei and tracts of the cord and medulla. For example, he shows how the olivary bodies are produced by a pouching off of a portion of the fourth ventricle on each side, and the migration of its cells to their positions near the ventral surface of the medulla.

This principle finds application elsewhere frequently in the brain. The cortical cells of the cerebrum, for example, are not all developed where they lie, but several well-marked areas of proliferation have been found from which cells pass to their respective sites. Thus, in the axial lobe, or brain base, of several groups of reptiles, cells are very rapidly formed, which seem to pass to the adjacent regions of the cortex.* Mr. Turner finds the same relations in birds.† In the fish brain, the entire *cortex cerebri* is represented by an epithelial membrane with no nervous organs, and these areas of proliferation in the axial lobes perform the whole function of the cerebrum.

We pass now to a series of investigations which may truly be called revolutionary. Since the time of Spinoza, it has been the custom to consider the central nervous system as analogous to a central battery system, toward which messages are sent along the various nerve fibers from the sensory organs, and from which similar messages are sent to the muscles and other instruments of volition. The transmission of such messages implies the physical union of the axis cylinder of a nerve fiber with a cell of the sensory or motor organ in question, on the one hand; on the other hand, physical union of the same fiber with some cell in the central nervous system, these cells being so connected as to insure the continuity of the motor with the sensory nerve systems. Upon this theory Professor Meynert based his now famous scheme of projection systems, tracing the path of a sensory impulse from cell to fiber and from fiber to cell, until it reaches the psychical cells of thought, in the cortex of the frontal lobes of the cerebrum, thence to the motor cells, the striatum, and the motor nerve.

But now Professor Golgi and his followers come forward and affirm that no nerve fiber is in direct physical continuity with a nerve cell at each end. Nervous excitation is not a mere transmission of an impulse through a suitable conductor, for the circuit is broken at many points. By processes of impregnation of the tissues with chromate of silver, now familiar to every histologist, they claim to make every finest nerve fibrilla stand out with diagrammatic distinctness, and that when thus differentiated every cell is found to be quite independent of every other cell. From each cell there pass two kinds of processes: First, an axis-cylinder process, which passes into the nerve fiber; and second, the protoplasmic processes, smaller and much branched, said by Golgi to be nutritive in function, but by others regarded as undoubtedly nervous. This, then, is our neurological unit, from which all nervous tissues are elaborated, a cell with its processes of two kinds. The axis-

*Jour. Comp. Neurol., I, p. 17.
†*Ibid.*, p. 71.

cylinder process always ends free, and usually breaks up at the tip into a brush of fine fibrils, which may be called the "terminal brush."

As to the relations of these nerve units to each other, it must first be borne in mind that, according to these authors, no nerve fiber passes directly into a cell at each end; second, that no ganglion cell has more than one axis-cylinder process springing from it; and, third, that each of these units is anatomically quite distinct from all the others. They do, however, come into very close relations. They may be adjacent and intertwine their processes, but actual continuity cannot be demonstrated. All this leads so conservative a writer as Professor Obersteiner to remark: "Hence, although we were before obliged to assume a continuity of the elements for the uninterrupted propagation of the nervous excitation, now we may no longer utterly reject the view that possibly even their contiguity may have the same functional significance."*

While our own observations lead to the belief that Golgi's method is very unreliable as a histological process, yet the relations here described are very strongly suggested, even by some of our hæmatoxylin preparations; and there can be but little doubt that mere proximity or contiguity is sometimes sufficient for nervous transmission. It would seem, then, that the neuroglia, or ground substance of the brain, must be in some way able to act as a conductor of nervous force, or else the process of transmission is analogous to induction rather than conduction.

The same anatomical relations have been very recently discovered in the invertebrates. If these positions can be substantiated, what a revolution it will work in our conceptions of the nervous system! Our whole theory of the nervous mechanism must be reconstructed.

Much might be said of the recent advances in the localization of brain functions, particularly in man and the higher apes. But more significant still is the fact that attention is being directed from the brains of the lower animals to the mental processes of which they are the organs; and the day is not far distant when we shall have a science of comparative psychology. As our knowledge of the functions of the human brain have been derived chiefly from comparison with lower animals, it seems not unreasonable that the same method should bear good fruit in the study of the mind.

A BREATHING WELL IN LOGAN COUNTY.

BY J. T. WILLARD, KANSAS STATE AGRICULTURAL COLLEGE.

For a number of years Mr. R. L. Smith, of Winona, has noticed that two wells there blow out air at times and draw it in at other times. He has also noticed a close connection between their action and the weather. One well he has noticed more especially, and became so satisfied that the movement of air was connected with the state of the atmosphere that he called it a natural barometer. He was very desirous that the well should be observed by some scientific man with the necessary instruments. An aneroid barometer was sent him to make observations with, at the same time recording the state of the well. His observations indicated quite clearly that the movement of air in and out of the well was dependent on the pressure of the atmosphere. As the case seemed interesting, the writer visited the well, taking with him an excellent mercurial barometer and such other apparatus as seemed likely to be useful.

* Recent Views on the Structure of the Nervous System, Naturwissenschaftlichen Rundschau, VII, 1 and 2. Translated in Jour. Comp. Neurol., II, pp. 73–84.

The well was found to be a bored one, cased with lumber. It was about eight inches in diameter. Water is reached in this region at about 130 feet, but this particular well had been drilled much deeper. This fact had no influence on the blowing of air, however, as other wells in the vicinity not over 135 feet deep show the same phenomenon. The well is abandoned now, on account of machinery having been lost in it which interferes with its use.

On reaching the well, the writer first sealed the top, by means of mortar and plaster of Paris, air-tight, inserting a one fourth inch brass tube to connect the well with a gauge. The gauge consisted of a simple U tube of glass, bent so that the two limbs were side by side. The bend of the tube, and for several inches up, was filled with water, and a scale behind the glass tubes measured any difference in height between the two columns of water. On connecting this gauge with the well, if air had been blowing out, its tension was measured by the height to which the water in the outer limb rose above that of the inner. If, on the contrary, air was being drawn into the well, on attaching the gauge the water would stand higher in the inner limb.

The following abstract from the observations made during four days will serve to show the connection between the movement of air to and from the well and the fluctuations of the barometer.

DATE.	*Time.*	*Barometer, in millimeters.*	*Gauge, in millimeters.**
August 27	4:30 P. M.	674.15	29
August 27	5:30 "	673.75	28
August 27	6:30 "	673.65	23
August 27	7:55 "	673.60	21
August 27	9:00 "	673.70	16
August 28	6:15 A. M.	674.30	0
August 28	7:45 "	674.35	1
August 28	8:45 "	674.15	2
August 28	9:35 "	674.45	0
August 28	8:45 P. M.	678.50	—31
August 29	7:25 A. M.	681.15	—33
August 29	8:30 "	681.55	—31
August 29	10:00 "	681.90	—30
August 29	11:30 "	681.90	—24
August 29	1:00 P. M.	681.65	—17
August 29	3:40 "	681.40	—10

*The minus sign indicates a drawing in of air, the water standing higher in the inner limb of the gauge.

The observations made showed conclusively that, the air of the well being stationary, if the barometer fell the air of the well at once exerted a pressure outward, as shown by the water gauge. Should the barometer then remain stationary, the tension of the air of the well became gradually less until equilibrium was again established. As this well was closed by the gauge, the evidence was conclusive that the tension was relieved by the escape of air from other openings, probably neighboring wells. Equilibrium being established, should the barometer rise, the gauge showed that the tension of the air of the well was less than that of the atmosphere, and this inequality was corrected by an inflow of air. If after a fall of the barometer a rise should ensue before equilibrium was established, the gauge would still show a greater internal tension; the well was therefore less delicate than the barometer, because of the interval of time required for the necessary movement of the air. After a sudden and considerable change of the barometer, a strong movement of air to or from the well would be caused, and this movement would continue for some hours, even though the barometer might be slowly returning to its original height.

These wells doubtless tap a subterranean reservoir of air, probably filling the interstices of sand or gravel beds. When the pressure of the external air is diminished, some of this imprisoned air escapes, and the greater the fall of the barometer the greater the force with which the air is expelled. My friend, Mr. Smith, utilized this air current to blow a whistle, which could be heard all over the town, warning the inhabitants of a possible storm. With a rising barometer, caused by an increase in the pressure of the air, air will be forced back into the subterranean reservoir. Mr. Smith tells me that when the air is going into the well, the water recedes a certain amount, and that when the air is blowing out, it can be heard bubbling through the water.

ADDITIONAL NOTE ON THE BRENHAM METEORITE.

BY ROBERT HAY.

About the end of 1891, the finds of the meteoric fall in Kiowa county were extended nearly a mile east of the former ones, and most of them are of a new type. Several groups were found, each in an area of several square yards, and having several hundred individuals. The aggregate number was about 3,000. Some of them

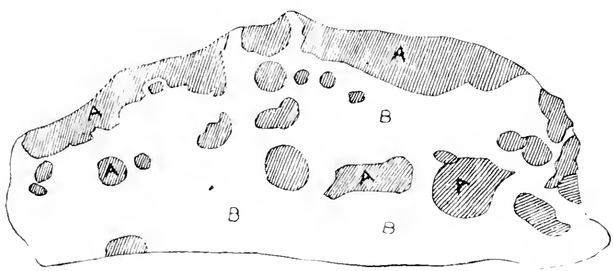


FIG. 14. POLISHED SECTION OF BRENHAM METEORITE: *a*, cavities containing olivene; *b*, Widmanstättian figures on polished surface.

seemed to be the decomposed parts of a larger mass, but the bulk of them were evidently separate meteorites. A few were about a pound in weight; others were from six or seven ounces down to the size of a pea. All were more or less oxidized; some had lost all their metallic structure, but some, even of the very smallest, had the true pallasite structure. A specimen (exhibited to the Academy) had been pronounced by Professor Foote, of Philadelphia, to be almost identical with the original meteorite of Pallas, which gives the name to this variety. There was one mass of nearly 80 pounds. There seem to have been no more finds, though the search was active.

NOTE ON THE OCCURRENCE OF GRANITE IN A DEEP BORING IN EASTERN KANSAS.

BY ROBERT HAY, F. G. S. A.

Four borings (one reaching 1,000 feet in depth) at Fort Scott have passed through the coal measures and subcarboniferous rocks at that place. The deep boring at Pittsburg (1,200 feet) is said by Mr. St. John to reach silurian rocks. The boring at Leavenworth (1,800 feet) is also said to have its bottom in siluria. Neither the well seven miles east of Wichita (1,943 feet) nor the boring at Anthony (2,300 feet) passed through the carboniferous formations, thus showing the increase of thickness westerly. The 1,200-foot boring at Cherry Vale reaches the bottom of the coal measures at 1,000 feet; the rest is in subcarboniferous. This boring well illustrates a fact otherwise known, that the best coal is at the bottom of the carboniferous formations. The recent experiences at Alma and McFarland tell the same story. Since the borings for gas at Paola, reported by the writer six years ago, there have been upwards of 60 prospect holes bored in that vicinity. Some of them have paid in gas and oil; most of them are barren. One of the latter is the deepest well in the State: it has a depth of 2,500 feet. It was bored by Mr. Nickerson. After passing through the coal measures and subcarboniferous, it is difficult to say where the formations belong geologically, the samples being so finely comminuted. But at about 2,100 feet it is manifest that the stratified rocks have all been passed. What is below is granite. One specimen is finely-comminuted gray granite—angular quartz, and mica, with some feldspar—and then we have red feldspar, with little mica and no quartz, like the outcrop in Ute Pass, Colorado. We shall give this boring further study.

NOTES ON A PINK BARITE FROM ATCHISON LIMESTONE.

BY E. B. KNERR.

Barite occurs quite frequently associated with limestone, and in many shades of color, but, so far as we could ascertain, a pink barite has not hitherto been reported. Last spring, however, such a specimen was found by the author of this paper, in small quantity, in a crevice in the lime rock of a quarry south of Atchison. Analysis gave the following composition for the mineral:

BaO	63.73
SrO	15
FeO	13
SO_3	34.44
SiO_2	1.43
	99.88

The specific gravity was found to be 4.28.

A REVISED LIST OF KANSAS MINERALS.

BY G. H. FAILYER AND E. H. S. BAILEY.

A list of Kansas minerals was published by the late Prof. B. F. Mudge, in the Transactions of the Kansas Academy of Science for 1880. Since that time, numerous additions have been made to this list, both by the discovery of minerals in new localities and by the discovery of minerals not heretofore found in the State.

In the list given below, no attempt is made to name all the counties in which some of the very abundant minerals occur, but only to mention some of the most important localities. The authorities have been consulted in nearly every case, and great care has been exercised not to mention the occurrence of minerals merely upon heresay evidence. In a few instances, where a mineral has been observed by only one person, his name is given in brackets. In regard to the mineralogy of Cherokee county, it is proper to state that it has been very thoroughly studied by Prof.

E. Haworth, and he is given as authority for many of the species mentioned as coming from that county.

The varieties are given under the head of the common mineralogical name. In the arrangement, we have followed the system used in Dana's Mineralogy, edition of 1892, the numbers used corresponding to those contained in that treatise.

No. and name.	*County.*
3. Sulphur	Cherokee.
25. Meteorite	Kiowa, Mitchell, Leavenworth, Logan (meteoric dust), Washington.
45. Galenite	Cherokee, Chautauqua, Douglas, Elk, Linn.
58. Sphalerite	Cherokee, Douglas (in concretions), Ford, Linn.
68. Greenockite	Cherokee.
83. Chalcopyrite	Cherokee.
85. Pyrite	Allen, Bourbon, Cherokee, Dickinson, Garfield, Jackson, Linn, Morris, Riley, Wabaunsee, and other counties.
96. Marcasite	Cherokee, Jackson, Osage, Sedgwick.
166. Halite	Ellsworth, Harper, Kingman, Reno, Rice, Saline.
210. Quartz	Cherokee, Riley, Woodson. In small crystals, abundant in many parts of the State.
Amethyst	Woodson.
Agate	Graham, Gove (moss agate) [Savage], Logan, Trego; also in drift in various counties.
Carnelian	Found in drift.
Chalcedony	Found in drift.
Chert	Cherokee, Woodson.
Jasper	Graham, Gove (banded) !! [Savage], Logan, Trego.
Silicified wood	Pottawatomie.
232. Hematite	In small quantities, widely disseminated.
233. Menaccanite	Riley.
234. Spinel (ruby)	Riley.
254. Pyrolusite	Kingman [Breese], Logan [Willis], Pottawatomie [Failyer], Washington.
259. Limonite	Cherokee, Dickinson.
Ochre	Barber, Harper, Leavenworth, Montgomery, Morris, Osage, Pottawatomie, Saline, Sumner.
270. Calcite	Cherokee, Logan, Trego, Wallace, Riley, in geodes; Johnson and Wyandotte, as oölitic limestones; Rush, like sphalerite in appearance.
Chalk	Gove, Graham, Ellis, Logan, Trego.
271. Dolomite	Bourbon, Cherokee, Douglas.
273. Siderite	Ottawa [Mason].
275. Smithsonite	Cherokee.
279. Witherite	Garfield [Bailey].
281. Cerussite	Cherokee.
288. Malachite	Cherokee, Sumner.
289. Azurite	Cherokee.
291. Hydrozincite	Cherokee.
313. Orthoclase	Found in drift.
338. Hornblende	Found in drift.
423. Calamine	Cherokee.
462. Biotite	Found in drift.

No. and name.	*County.*
492. Kaolinite (clay)	Cherokee, Linn, Morris, Osage, and in most of the counties of the State.
Catlinite	Pottawatomie [Failyer], in drift.
597. Vivianite	Douglas [Bailey], Nemaha [Willard].
719. Barite	Atchison [Knerr], Brown, Cherokee, Ellis, Graham, Jefferson, Logan, Lane, Nemaha, Ness, Scott, Sheridan, Wallace, and in Douglas in concretions.
720. Celestite	Garfield, Riley, Saline, Washington: also in concretions in Douglas, Jefferson, and Riley.
721. Anglesite	Cherokee.
722. Anhydrite	Ellsworth [Failyer], Kingman [Willard].
743. Mirabilite	Common as an incrustation in many of the western counties. Known as "Alkali."
745. Gypsum	Very abundant in many of the southern and western counties, especially in Barber, Comanche, Clark, Ellis, Logan, Marshall, Meade, Saline.
Alabaster	Franklin, Mitchell.
Satin spar Selenite	Cherokee.
749. Goslarite	Cherokee.
Coal	Bourbon, Cherokee, Crawford, Linn, Leavenworth, Osage. As lignite and earthy varieties in Douglas, Cowley, Franklin, Geary, Jackson, Leavenworth, Mitchell, McPherson, Montgomery, Miami, Neosho, Riley, Wabaunsee.

ON THE COMPOSITION OF SOME KANSAS BUILDING STONES.

E. H. S. BAILEY AND E. C. CASE.

The building stones of the State have never been systematically examined. It is true that there are various reports and analyses in the publications of the State, and in the meager geological reports: there are also a few descriptions of rocks and their localities, but in some cases only the local name of the stone is given, and this is liable to mislead. As, for instance, when a stone is called a marble that is really a gypsum, or a granite when it is a sandstone.

In conjunction with the work of Professor Williston on the structure of the stones, and of Professor Marvin on their resistance to strain, the chemical department has undertaken to make analyses of the more important rocks from various localities. These analyses are made as complete as the case seemed to demand. In most of them a test has been made for sulphates, as their presence has an important influence upon the lasting qualities of the stone. Not more than 1.36 per cent. of sulphate of lime has been found thus far in any sample. One of the purest limestones, that from Garnett, contains 97.32 per cent. of carbonate of lime. In the limestones, the iron that is present is nearly all in the ferrous state. Whether this has any influence on the durability of the stone has not been determined.

Some of the stones are locally known as "magnesian limestones," but the analysis shows that none of them, with a few notable exceptions, contain much over 2 per cent. of magnesium carbonate. The complete analyses of these rocks, with all the data in regard to their structure, strength, and occurrence, is attached to the specimens now on exhibition at the Columbian Exposition, and will be published later.

THE DISTRIBUTION OF THE GENUS VITIS IN KANSAS.

BY A. S. HITCHCOCK, STATE AGRICULTURAL COLLEGE, MANHATTAN.

So far as I have been able to ascertain, the genus *Vitis* is represented in Kansas by five species, excluding the widely-distributed *Vitis indivisa*, which is placed by American botanists under *Cissus ampelopsis*.

Linnæus described but two species of *Vitis* from North America — *V. labrusca* and *V. vulpina* — neither of which I have seen in Kansas.

Three of our species were first described by Michaux in his Flora Boreali Americana, vol. II, pp. 230 and 231 (1803).

V. æstivalis Mx. Fl.—Of this Michaux says, in his original description, translating from the Latin: "Leaves widely cordate, 3-5 lobed, sparsely tomentose beneath, hairs red, sinus obtusely rounded, fertile racemes, oblong, fruit small. Commonly called summer grape. Habitat in woods from Virginia to Carolina."

This is a high climber, with large, frequently deeply-lobed, leaves, which, with age, tend to become glaucous beneath, and, in the variety *bicolor*, are conspicuously so. The canes are smooth and more or less glaucous. The fruit is larger than that of any other species we have, and is very pleasantly flavored. Some of the berries gathered at Baxter Springs, Cherokee county, would make a very fair table fruit, and it seems deserving of cultivation. It occurs in Johnson and Cherokee counties, and probably more or less through the eastern tier of counties, from the Missouri river south. In Cherokee county, the variety *bicolor* is abundant.

V. cinerea Engelm.—This was first described by Doctor Engelmann as a variety of *V. æstivalis* (Gray's Manual, ed. 5, 1868). He afterwards raised it to the rank of a distinct species. It is easily distinguished from *V. æstivalis*, which it closely resembles, by the branchlets being loosely woolly, the leaves being scarcely at all lobed, and the pubescence ashy and not red. The fruit is small, and ripens late in the fall, being still green when the fruit of *V. æstivalis* is ripe — the latter part of July in Cherokee county. It occurs in the following counties: Atchison, Wyandotte, Johnson, Miami, Linn, Bourbon, Cherokee, Labette, Montgomery, Jackson, Shawnee, Greenwood, Riley, and Norton, thus being quite general through eastern Kansas.

V. cordifolia Mx.—This is described by Michaux as follows: "Leaves cordate, acuminate, subequally dentate, glabrous both sides, raceme laxly many flowered, berries small, ripening late. Called by the inhabitants, 'winter grape.' Habitat from Pennsylvania to Florida."

This occurs over nearly the same range as the previous species — Doniphan, Atchison, Miami, Linn, Bourbon, Cherokee, Labette, Montgomery, Greenwood, Pottawatomie, and Riley.

V. riparia Mx.—Michaux characterizes this species as follows: "Leaves unequally incisely dentate, shortly three-lobed, petioles, nerves and margins pubescent. Called by the French inhabitants, 'sand-bank grape.' Habitat along rivers and on river islands in Ohio, Mississippi, etc."

This is the most widely-distributed grape in Kansas, occurring throughout the State as far west as Barber and Decatur counties.

This species has often been confounded with *V. cordifolia*, but is easily distinguished by the leaf characters brought out by Michaux. *V. cordifolia* has the teeth nearly equal, while in *V. riparia* the teeth are quite unequal and the leaf is more or less three lobed, the lobes being acuminate. The leaves of *V. cordifolia* are sometimes deeply lobed, but the lobes are not so acuminate and the sinuses are rounded.

The character of the teeth is quite constant. The fruit of *V. riparia* is ripe here in August, while that of *V. cordifolia* is not ripe till late in the fall.

V. novo-mexicana.—This is represented by specimens from Hamilton and Barber counties, in southwestern Kansas. I found it also in Montgomery county, along a railroad track, where it was apparently introduced. It is characterized by a shrubby habit and leaves of *V. riparia*, but woolly on both sides, as are the canes. The wool is more or less deciduous on the old portions. The specimens were gathered in July, at which time berries were apparently full grown, but still green Bunches short and compact.

A LIST OF FLOWERING PLANTS AND FERNS.

[Collected in Franklin county, Kansas, during the months of April, May, September, and October, 1890–'92.]

BY W. E. CASTLE, OTTAWA, KAS.

EXPLANATION: In the following list, the nomenclature of Gray's Manual, sixth edition, has been followed.

Every plant included in the list has been seen and identified by the author, with one exception, which is noted. Dried specimens of nearly all are in the author's herbarium. In cases of doubtful identity, comparison has been made with the herbaria of Harvard University and the Missouri Botanical Garden. Acknowledgment of valuable assistance is due to Mr. Herbert L. Jones, of Cambridge, Mass., Dr. Wm. Trelease, of St. Louis, and others.

As many of the plants were collected when in fruit or before blossoming, the *time* of collection has not been thought of sufficient value for insertion; for the benefit, however, of future botanical students in the vicinity of Ottawa, the *place* of collection has been indicated with considerable exactness. The letters, A to K, refer to the following localities:

A, the college farm, just outside the corporate limits of Ottawa, on the south, and thence along the south bank of Rock creek to the Marais des Cygnes river; soil stony, untimbered.

B, more or less wooded banks of Rock creek, on the college farm and between the college farm and the river.

C, shaded banks of the Marais des Cygnes, between Ottawa and the mouth of Rock creek.

D, swampy ground on the north bank of Rock creek near its mouth.

E, on or among the sandstone hills about three miles southwest of Ottawa.

F, alluvial soil, about one mile west of Main street, Ottawa.

G, Forest Park, on the north bank of the Marais des Cygnes, in the city of Ottawa; open woods.

H, banks of Skunk run, city of Ottawa.

I, Missouri Pacific railroad track, between Ottawa and Rock creek.

K, streets of Ottawa.

The underlying rock is everywhere limestone, except at station E, where it is sandstone.

I.—RANUNCULACEÆ.

1. *Clematis* L.

1. C. pitcheri T. & G. . . . . B

2. *Anemone* Tourn.

2. A. caroliniana Walt . . . . A
3. A. virginiana L.

3. *Thalictrum* Tourn.

4. T. purpurascens L. . . . . B

4. *Myosurus* Dill.

5. M. minimus L. . . . . A

5. *Ranunculus* Tourn.

6. R. abortivus L. . . . . G
7. R. recurvatus Poir. . . . . G

6. *Isopyrum* L.

8. I. biternatum T. & G. . . . . . C and G

7. *Aquilegia* Tourn.

9. A canadensis L. . . . . B

8. *Delphinium* Tourn.

10. D. tricorne Mx . . . . B
11. D. azureum Mx. . . . . A

II.—MENISPERMACEÆ.

9. *Menispermum* L.

12. M. canadense L. . . . . B

III.—BERBERIDACEÆ.

10. *Podophyllum* L.

13. P. peltatum L. . . . . B

IV.—PAPAVERACEÆ.

11. *Sanguinaria* Dill.

14. S. canadensis L., rare . . . . B

V.—FUMIARIACEÆ.

12. *Discentra* Borkh.

15. D. cucullaria, DC. . . . . B

13. *Corydalis* Vent.

16. C. flavula DC. . . . . B
17. C. micrantha Gr. . . . . A
18. C. aurea Willd., var. occidentalis Engl. . . . . A

VI.—CRUCIFERÆ.

14. *Dentaria* Tourn.

19. D. laciniata Muhl. . . . . B

15. *Cardamine* Tourn.

20. C. hirsuta L . . . . E

16. *Arabis* L.

21. A. canadensis L. . . . . A
22. A. dentata T. & G. C

17. *Draba* Dill.

23. D. caroliniana Walt., var. micrantha Gr . . . . A
24. D. cuneifolia Nutt. . . . . A

18. *Nasturtium* R. Br.

25. N. sessiliflorum Nutt . . . . K

19. *Sisymbrium* Tourn.

26. S. canescens Nutt . . . . B
27. S. officinale Scop . . . . K

20. *Thelypodium* Endl.

28. T. pinnatifidum Watson . . . . G

21. *Brassica* Tourn.

29. B. sinapistrum Boiss., in grain fields becoming common.

22. *Capsella* Medic.

30. C. bursa-pastoris Moench (found everywhere).

23. *Lepidium* Tourn.

31. L. virginicum L. . . . . Roadsides
32. L. intermedium Gr. . . . . . Roadsides

VII.—VIOLACEÆ.

24. *Viola* Tourn.

33. V. pedata L . . . . E
34. V. pedatifida G. Don. . . . . . A and B
35. V. palmata L., var. cucullata Gray . . . . Everywhere
36. V. pubescens Ait. . . . . B and C
37. V. tricolor L., var. arvensis (?). . . A

VIII.—CAROPHYLLACEÆ.

25. *Saponaria* L.

38. S. officinalis L. . . . . K

26. *Silene* L.

39. S. antirrhina L. . . . . A

27. *Stellaria* L.

40. S. media Smith, in garden at green-house, May, 1892.

28. *Cerastium* L.

41. C. nutans Raf., common . . . . A
42. C. arvense L., rare.

IX.—PORTULACACEÆ.

29. *Portulaca* Tourn.

43. P. oleracea L., rare. . . . . Gardens
44. P. pilosa L . . . . A

30. *Claytonia* Gronov.

45. C. virginica L. . . . . A and C

X.—HYPERICACEÆ.

31. *Hypericum* Tourn.

46. H. densiflorum Pursh. . . . . D

XI.—MALVACEÆ.

32. *Callirrhoe* Nutt.

47. C. alcæoides Gr. . . . . A

33. *Malvastrum* Gr.

48. M. angustum Gr. . . . . A

34. *Sida* L.

49. S. spinosa L....................A

35. *Abutilon* Tourn.

50. A. avicennæ Gaertn.

36. *Hibiscus* L.

51. H. trionum L..................A

XII.—TILIACEÆ.

37. *Tilia* Tourn.

52. T. americana L............Woods

XIII.—LINACEÆ.

38. *Linum* Tourn.

53. L. sulcatum Riddell.............A

54. L. usitatissimum L..............I

XIV.—GERANIACEÆ.

39. *Geranium* Tourn.

55. G. carolinianum L..............A

40. *Oxalis* L.

56. O. violacea L. (a variety occurs with white petals).................A

57. O. corniculata L................A

58. O. corniculata, var. stricta Sav., blossoms later than the species....A

41. *Impatiens* L.

59. I. pallida Nutt..................C

XV. CELASTRACEÆ.

42. *Celastrus* L.

60. C. scandens L..................B

43. *Euonymus* Tourn.

61. E. atropurpureus Jacq..........C

XVI.—RHAMNACEÆ.

44. *Rhamnus* Tourn.

62. R. lanceolata Pursh.............C

45. *Ceanothus* L.

63. C. americanus L................A

XVII.—VITACEÆ.

46. *Vitis* Tourn.

64. V. cinerea Engl.................H

65. V. riparia Mx...................B

47. *Ampelopsis* Mx.

66. A. quinquefolia Mx........B and C

XVIII.—SAPINDACEÆ.

48. *Æsculus* L.

67. Æ. argnta Buckley..............B

49. *Acer* Tourn.

68. A. dasycarpum Ehrh............C

50. *Negundo* Moench.

69. N. aceroides Moench............G

51. *Staphylea* L.

70. S. trifolia L..............B and C

XIX.—ANACARDIACEÆ.

52. *Rhus* L.

71. R. glabra L ....A

72. R. toxicodendron L.......B and C

73. R. canadensis Marsh............A

XX.—POLYGALACEÆ.

53. *Polygala* Tourn.

74. P. sanguinea L.................A

75. P. verticillata L ....A

XXI.—LEGUMINOSÆ.

54. *Baptisia* Vent.

76. B. leucophæa Nutt..............A

77. B. australis R. Br.

55. *Trifolium* Tourn.

78. T. pratense L.........Everywhere

79. T. repens L...........Everywhere

56. *Melilotus* Tourn.

80. M. officinalis Willd..............K

81. M. alba Lam....................K

57. *Medicago* Tourn.

82. M. sativa L., orchard............A

58. *Hosackia* Douglas.

83. H. Purshiana Benth.............A

59. *Psoralea* L.

84. P. tenuiflora Pursh..............A

85. P. esculenta Pursh..............A

60. *Amorpha* L.

86. A. canescens Nutt.............. A

87. A. fruticosa L ....A

61. *Dalea* L.

88. D. alopecuroides Willd..........A

62. *Petalostemon* Mx.

89. P. multiflorus Nutt...............A

63. *Robinia* L.

90. R. pseudacacia L. (escaping from cultivation).

64. *Astragalus* Tourn.

91. A. caryocarpus Ker ....A

92. A. canadensis L ....F

65. *Desmodium* Desv.

93. D. acuminatum DC . ...B

94. D. dillenii Darlingt ....B

66. *Lespedeza* Mx.

95. L. violacea Pers ....A

96. L. capitata Mx.................A

97. L. striata Hook & Arn...........I

67. *Vicia* Tourn.

98. V. americana Muhl ....D

68. *Strophostyles* Ell.

99. S. angulosa Ell..................I

69. *Amphicarpæa* Ell.

100. A. monoica Nutt................B
101. A. pitcheri T. & G.

70. *Cercis* L.

102. C. canadensis L.................B

71. *Cassia* Tourn.

103. C. marylandica L...............H
104. C. chamæcrista L...............A

72. *Gymnocladus* Lam.

105. G. canadensis Lam ....B and G

73. *Gleditschia* L.

106. G. triacanthos L................B

74. *Desmanthus* Willd.

107. D. brachylobus Benth...........F

XXII.—ROSACEÆ.

75. *Prunus* Tourn.

108. P. chicasa Mx ....B

76. *Rubus* Tourn.

109. R. occidentalis L...............B
110. R. villosus Ait.................B
111. R. canadensis L..........A and B

77. *Geum* L.

112. G. album Gmelin ....B
113. G. vernum T. & G.......Thicket F

78. *Fragaria* Tourn.

114. F. virginiana Mill., var. illinoensis Gr...........................A

79. *Potentilla* L.

115. P. norvegica L............ ....K
116. P. canadensis L..........A and B

80. *Agrimonia* Tourn.

117. A. eupatoria L.
118. A. parviflora Ait........Thicket F

81. *Rosa* Tourn.

119. R. setigera Mx.................B
120. R. arkansana Porter ....A

82. *Pyrus* L.

121. P. coronaria L........ ....B

83. *Cratægus* L.

122. C. coccinea L..................B

XXIII.—SAXIFRAGACEÆ.

84. *Ribes* L.

123. R. gracile Mx..................B

XXIV.—CRASSULACEÆ.

85. *Penthorum* Gronov.

124. P. sedoides L.... ....E

86. *Sedum* Tourn.

125. S. pulchellum Mx...............A

XXV.—LYTHRACEÆ.

87. *Lythrum* L.

126. L. alatum Pursh..........A and D

XXVI.—ONAGRACEÆ.

88. *Jussiæa* L.

127. J. repens L.....................I

89. *Ludwigia* L.

128. L. alternifolia L...............D
129. L. polycarpa Short & Peter..... D
130. L. palustris Ell................D

90. *Œnothera* L.

131. Œ. albicaulis Nutt.........A and B
132. Œ. missouriensis Sims...........I

91. *Gaura* L.

133. G. biennis L...................A

92. *Stenosiphon* Spach.

134. S. virgatus Spach...............A

XXVII.—LOASACEÆ.

93. *Mentzelia* Plumier.

135. M. oligosperma Nutt............A

XXVIII.—CUCURBITACEÆ.

94. *Sicyos* L.

136. S. angulatus L..................C

95. *Echinocystis* T. & G.

137. E. lobata T. & G................C

XXIX.—CACTACEÆ.

96. *Opuntia* Tourn.

138. O. missouriensis DC.............A

XXX.—UMBELLIFERÆ.

97. *Pastinaca* L.

139. P. sativa L..............Common

98. *Polytænia* DC.

140. P. nuttallii DC..................A

99. *Peucedanum* L.

141. P. fœniculaceum Nutt............A

100. *Sium* Tourn.

142. S. cicutæfolium Mx.............D

101. *Zizia* Koch.

143. Z. aurea Koch.............B and F

102. *Chærophyllum* L.

144. C. procumbens Crantz.....B and G

103. *Osmorrhiza* Raf.

145. O. brevistylis DC...............C
146. O. longistylis DC...............C

104. *Eryngium* Tourn.

147. E. yuccæfolium Mx.............A

105. *Sanicula* Tourn.

148. S. marylandica L...............B

149. S. marylandica, var. canadensis Torr.... .... B

XXXI.—CORNACEÆ.

106. *Cornus* Tourn.

150. C. sericea L.................... B

XXXII.—CAPRIFOLIACEÆ.

107. *Sambucus* Tourn.

151. S. canadensis L........ A. B, and C

108. *Triosteum* L.

152. T. perfoliatum L................ B

109. *Symphoricarpus* Dill.

153. S. vulgaris Mx............ B and C

XXXIII.—RUBIACEÆ.

110. *Houstonia* L.

154. H. minima Beck................ A

111. *Cephalanthus* L.

155. C. occidentalis L.

112. *Diodia* Gronov.

156. D. teres Walt................... D

113. *Galium* L.

157. G. aparine L.................. B

158. G. circæzans Mx............... B

159. G. trifidum L.................. D

160. G. triflorum Mx.......... B and F

XXXIV.—VALERIANACEÆ.

114. *Valerianella* Tourn.

161. V. stenocarpa Krok............. B

XXXV.—COMPOSITÆ.

115. *Vernonia* Schreb.

162. V. fasiculata Mx................ D

163. V. baldwinii Torr............... F

116. *Eupatorium* Tourn.

164. E. purpureum L................ B

165. E. altissimum L................ A

166. E. ageratoides L............... B

117. *Kuhnia* L.

167. K. eupatorioides L.............. A

118. *Liatris* Schreb.

168. L. squarrosa Willd.............. A

169. L. punctata Hook............... A

170. L. pycnostachya Mx............ A

119. *Amphiachyris* Nutt.

171. A. dracunculoides Nutt.......... A

120. *Solidago* L.

172. S. bicolor L., var. concolor T. & G., A

173. S. ulmifolia Muhl....... ...... B

174. S missouriensis Nutt............ A

175. S. serotina Ait.................. A

176. S. canadensis L................. A

177. S. rigida L.................... A

178. S. tenuifolia Pursh.............. A

121. *Boltonia* L'Her.

179. B. latisquama Gr............... D

122. *Aster* L.

180. A. drummondii Lindl............ A

181. A. vimineus Lam............... K

182. A. diffusus Ait................. K

183. A. salicifolius Ait. .... A

123. *Erigeron* L.

184. E. canadensis L................ A

185. E. annuus Pers................ A

186. E. strigosus Muhl.............. A

187. E. philadelphicus L............. A

124. *Antennaria* Gaertn.

188. A. plantaginifolia Hook......... A

125. *Anaphalis* DC.

189. A. margaritacea Benth. & Hook.. A

126. *Silphium* L.

190. S. laciniatum L................ A

191. S. integrifolium Mx............ A

192. S. perfoliatum L............... H

127. *Iva* L.

193. I. ciliata Willd................. A

128. *Ambrosia* Tourn.

194. A. bidentata Mx................ A

195. A. trifida L.............. B and C

196. A. trifida, var. integrifolia Mx.... A

197. A. artemisiæfolia L.... Everywhere

198. A. psilostachya DC............. A

129. *Xanthium* Tourn.

199. X. canadense Mill............... K

130. *Eclipta* L.

200. E. alba Hassk.................. B

131. *Heliopsis* Pers.

201. H. scabra Dunal................ A

132. *Echinacea* Moench.

202. E. angustifolia DC.............. A

133. *Rudbeckia* L.

203. R. laciniata L.................. A

204. R. triloba L............. A and B

205. R. subtomentosa Pursh......... D

206. R. speciosa Wenderoth......... A

134. *Lepachys* Raf.

207. L. columnaris T. & G........... A

135. *Helianthus* L.

208. H. annuus L.................... A

209. H. orgyalis DC................. A

210. H. rigidus Desf..... .... A

211. H. lætiflorus Pers................A
212. H. mollis Lam ....A
213. H. grosse-serratus Martens.......I
214. H. strumosus L., var. mollis T. & G., A

136. *Actinomeris* Nutt.

215. A. squarrosa Nutt...............B

137. *Coreopsis* L.

217. C. involucrata Nutt. .....H and K

138. *Bidens* L.

218. B. frondosa L ....B
219. B. connata Muhl................B
220. B. bipinnata L ....B

139. *Helenium* L.

221. H. autumnale L.

140. *Dysodia* Cav.

222. D. chrysanthemoides Lag........K

141. *Anthemis* L.

223. A. cotula DC......Not common, K

142. *Achillea* L.

224. A. millefolium L................A

143. *Tanacetum* L.

225. T. vulgare L., escaping from yards.... ....K

144. *Artemisia* L.

226. A. ludoviciana Nutt.............A

145. *Senecio* Tourn.

227. S. aureus L............ ....D

146. *Cacalia* L.

228. C. atriplicifolia L................B
229. C. tuberosa Nutt ....A

147. *Erechtites* Raf.

230. E. hieracifolia Raf..............B

148. *Arctium* L.

231. A. lappa L..........Very common

149. *Cnicus* Tourn.

232. C. altissimus Willd...............I
233. C. arvensis Hoffm...............K

150. *Cichorium* Tourn.

234. C. intybus L.................Rare

151. *Prenanthes* Vaill.

235. P. aspera Mx...................A

152. *Troximon* Nutt.

236. T. cuspidatum Pursh............A

153. *Taraxacum* Haller.

237. T. officinale Weber.... Everywhere

154. *Lactuca* Tourn.

238. L. canadensis L.................A
239. L. hirsuta Muhl.

155. *Sonchus* L.

240. S. asper Vill....................K

XXXVI.—LOBELIACEÆ.

156. *Lobelia* L.

241. L. cardinalis L..................B
242. L. syphilitica L.................B

XXXVII.—CAMPANULACEÆ.

157. *Specularia* Heister.

243. S. perfoliata A. DC..............A
244. S. leptocarpa Gr................A

158. *Campanula* Tourn.

245. C. americana L.................B

XXXVIII.—PRIMULACEÆ.

159. *Androsace* Tourn.

246. A. occidentalis Pursh............A

XXXIX.—OLEACEÆ.

160. *Fraxinus* Tourn.

247. F. viridis Mx. f.................B

XL.—APOCYNACEÆ.

161. *Apocynum* Tourn.

248. A. cannabinum L.

XLI.—ASCLEPIADACEÆ.

162. *Asclepiodora* Gr.

249. A. viridis Gr....................A

163. *Asclepias* L.

250. A. tuberosa L...................I
251. A. incarnata L..................F
252. A. sullivantii Engl..............K
253. A. verticillata L ....K

XLII.—GENTIANACEÆ.

164. *Gentiana* Tourn.

254. G. puberula Mx.................A

XLIII.—POLEMONIACEÆ.

165. *Phlox* L.

255. P. pilosa L...............D and I
256. P. divaricata L........B, C, and G

XLIV.—HYDROPHYLLACEÆ.

166. *Hydrophyllum* Tourn.

257. H. virginicum L..........B and G

167. *Ellisia* L.

258. E. nyctelea L...................K

XLV.—BORAGINACEÆ.

168. *Cynoglossum* Tourn.

259. C. officinale L.

169. *Echinospermum* Lehm.

260. E. virginicum Lehm............C

170. *Myosotis* Dill.

261. M. verna Nutt..................A

171. *Lithospermum* Tourn.

262. L. officinale L. Woods along stream, eight miles southeast of Ottawa.
263. L. canescens Lehm..............A
264. L. angustifolia Mx..............A

172. *Onosmodium* Mx.

265. O. carolinianum DC., var. molle Gr..........................A

173. *Lycopsis* L.

266. L. arvensis L. Eight miles southeast of Ottawa.

XLVI.—CONVOLVULACEÆ.

174. *Ipomœa* L.

267. I. hederacea Jacq. Spontaneous in gardens, Ottawa.
268. I. purpurea Lam. Spontaneous in gardens, Ottawa.
269. I. lacunosa L. Spontaneous in gardens, Ottawa.

175. *Convolvulus* Tourn.

270. C. sepium L...................A

176. *Cuscuta* Tourn.

271. C. chlorocarpa Engl. (parasitic on Polygonum hydropiperoides)..B
272. C. cuspidata Engl. (parasitic on Ambrosia artimisiæfolia and Artemisia trifida)...........A
273. C. glomerata Choisy (parasitic on Helianthus)..................I

XLVII.—SOLANACEÆ.

177. *Solanum* Tourn.

274. S. nigrum L..............A and B
275. S. carolinense L ....K
276. S. rostratum Dunal.............K

178. *Physalis* L.

277. P. pubescens L. (differs greatly from the eastern form). A, and in clearing B.
278. P. virginiana Mill., var. ambigua Gr..........................C
279. P. lanceolata Mx................A
280. P. lanceolata Mx., var. lævigata Gr. (more angulate toothed than species — almost glabrous.........A
281. P. lanceolata Mx., var. hirta Gr.

179. *Datura* L.

282. D. stramonium L...............K
283. D. tatula L....................K

XLVIII.—SCROPHULARIACEÆ.

180. *Verbascum* L.

284. V. thapsus L...................A

181. *Scrophularia* Tourn.

285. S. nodosa L., var. marilandica Gr..B

182. *Pentstemon* Mitchell.

286. P. lævigatus Solander...........A
287. P. cobæa Nutt..................A

183. *Mimulus* L.

288. M. alatus Ait..................B

184. *Conobea* Aublet.

289. C. multifida Benth..............B

185. *Gratiola* L.

290. G. virginiana L....River banks, G

186. *Veronica* L.

291. V. peregrina L.................A

187. *Seymeria* Pursh.

292. S. macrophylla Nutt.............B

188. *Gerardia* L.

293. G. auriculata Mx...............A
294. G. purpurea L..................A
295. G. tenuifolia Vahl..............A

189. *Pedicularis* Tourn.

296. P. canadensis L................B

XLIX.—ACANTHACEÆ.

190. *Ruellia* Plumier.

297. R. ciliosa Pursh................K
298. R. strepens L..................B

L.—VERBENACEÆ.

191. *Verbena* Tourn.

299. V. urticæfolia L...............A
300. V. angustifolia Mx.............A
301. V. stricta Vent............A and K
302. V. aubletia L..................A

192. *Lippia* Houst.

303. L. lanceolata Mx...............B

193. *Phryma* L.

304. P. leptostachya L...............B

LI.—LABIATÆ.

194. *Isanthus* Mx.

305. I. cæruleus Mx.................A

195. *Teucrium* Tourn.

306. T. canadense L.................K

196. *Mentha* Tourn.

307. M. canadensis L., var. glabrata Benth.......................B

197. *Lycopus* Tourn.

308. L. virginicus L................B

198. *Pycnanthemum* Mx.

309. P. linifolium Pursh.............K

199. *Hedeoma* Pers.

310. H. drummondi Benth............A

200. *Salvia* L.

311. S. azurea Lam., var. grandiflora Benth........................K
312. S. lanceolata Willd..............K

201. *Monarda* L.

313. M. fistulosa L..................B

202. *Lophanthus* Benth.

314. L. nepetoides Benth.............B

203. *Nepeta* L.

315. N. cataria L....................F
316. N. glechoma Benth...............K

204. *Scutellaria* L.

317. S. wrightii Gr..................A
318. S. parvula Mx...................A
319. S. parvula, var. mollis Gr., blossoms earlier than species...........B

205. *Brunella* Tourn.

320. B. vulgaris L...................K

206. *Stachys* Tourn.

321. S. aspera Mx., var. glabra Gr....B

LII.—PLANTAGINACEÆ.

207. *Plantago* Tourn.

322. P. major L.....................K
323. P. patagonica Jacq., var. gnaphalioides Gr....................A
324. P. patagonica Jacq., var. aristata Gr....................A and K
325. P. virginica L.................A

LIII.—NYCTAGINACEÆ.

208. *Oxybaphus* Vahl.

326. O. nyctagineus Sweet............B
327. O. angustifolius Sweet..........A

LIV.—ILLECEBRACEÆ.

209. *Anychia* Mx.

328. A. dichotoma Mx................A

LV.—AMARANTACEÆ.

210. *Amarantus* Tourn.

329. A. paniculatus L................K
330. A. retroflexus L................K
331. A. chlorostachys Willd..........K
332. A. albus L.....................K
333. A. blitoides Watson.............K

LVI.—CHENOPODIACEÆ.

211. *Chenopodium* Tourn.

334. C. polyspermum L...............K
335. C. album L.....................K
336. C. ambrosioides L., var. anthelminticum Gr....................K

LVII.—PHYTOLACCACEÆ.

212. *Phytolacca* Tourn.

337. P. decandra L.........A, I, and K

LVIII.—POLYGONACEÆ.

213. *Rumex* L.

338. R. crispus L...................K

214. *Polygonum* Tourn.

339. P. aviculare L.................K
340. P. erectum L...................K
341. P. ramosissimum Mx.............K
342. P. lapathifolium L., var. incarnatum Watson, river bank near G
343. P. pennsylvanicum L., rich soil everywhere.
344. P. muhlenbergii Watson.........D
345. P. hartwrightii Gr..............D
346. P. persicaria L........Everywhere
347. P. hydropiperoides Mx..........K
348. P. hydropiper L.......Everywhere
349. P. virginianum L...............C
350. P. convolvulus L.........A and B
351. P. dumetorum L., var. scandens Gr.........................C

LIX.—SANTALACEÆ.

215. *Comandra* Nutt.

352. C. pallida A. DC................E

LX.—EUPHORBIACEÆ.

216. *Euphorbia* L.

353. E. petaloidea Engl..............A
354. E. serpens, HBK................A
355. E. glyptosperma Engl............A
356. E. maculata L.........A, I, and K
357. E. preslii Guss.........A, I, and K
358. E. corollata L..................A
359. E. dentata Mx...................K
360. E. heterophylla L...............C

217. *Croton* L.

361. C. capitatus Mx.................A

218. *Crotonopsis* Mx.

362. C. linearis Mx..................A

219. *Acalypha* L.

363. A. virginica L..................A
364. A. virginica, var. gracilens Muell..I

220. *Tragia* Plumier.

365. T. nepetæfolia Cav..............A

LXI.—URTICACEÆ.

221. *Ulmus* L.

366. U. fulva Mx .... B
367. U. americana L .... Everywhere

222. *Celtis* Tourn.

368. C. occidentalis L................ B

223. *Cannabis* Tourn.

369. C. sativa .... A

224. *Humulus* L.

370. H. lupulus L................... B

225. *Maclura* Nutt.

371. M. aurantiaca Nutt. (becoming spontaneous)................. A

226. *Morus* Tourn.

372. M. rubra L.................... C

227. *Urtica* Tourn.

373. U. gracilis Ait .... A and B

228. *Laportea* Gaudichaud.

374. L. canadensis Gaud............. C

229. *Pilea* Lindl.

375. P. pumila Gr.................. B

230. *Parietaria* Tourn.

376. P. pennsylvanica Muhl. (hedge rows)...................... K

LXII.—PLATANACEÆ.

231. *Platanus* L.

377. P. occidentalis L............... C

LXIII.—JUGLANDACEÆ.

232. *Juglans* L.

378. J. nigra L..................... G

233. *Carya* Nutt.

379. C. alba Nutt................... B
380. C. sulcata Nutt .... B
381. C. amara Nutt. .... D

LXIV.—CUPULIFERÆ.

234. *Corylus* Tourn.

382. C. americana Walt .... B

235. *Ostrya* Micheli.

383. O. virginica Willd............... B

236. *Quercus* L.

384. Q. macrocarpa Mx.............. G
385. Q. bicolor Willd................. C
386. Q. muhlenbergii Engl..... ..... G
387. Q. rubra L..................... G
388. Q. palustris Du Roi............. D
389. Q. nigra L .... B

LXV.—SALICACEÆ.

237. *Salix* Tourn.

390. S. nigra Marsh................. C
391. S. longifolia Muhl......... I and D
392. S. tristis Ait.................... E

238. *Populus* Tourn.

393. P. monilifera Ait.......... B and C

LXVI.—ORCHIDACEÆ.

239. *Cypripedium* L.

394. C. parviflorum Salisb. Woods, creeks, eight miles southeast of Ottawa.

LXVII.—IRIDACEÆ.

240. *Sisyrinchium* L.

395. S. angustifolium Mill............ A

LXVIII.—AMARYLLIDACEÆ.

241. *Hypoxis* L.

396. H. erecta L.................... A

LXIX.—DIOSCOREACEÆ.

242. *Dioscorea* Plumier.

397. D. villosa L .... B

LXX.—LILIACEÆ.

243. *Smilax* Tourn.

398. S. herbacea L............. I and D
399. S. ecirrhata Watson............. B
400. S. hispida Muhl................ B

244. *Allium* L.

401. A. stellatum Nutt .... A
402. A. canadense Kalm.............. B

245. *Nothoscordum* Kunth.

403. N. striatum Kunth .... A

246. *Camassia* Lindl.

404. C. fraseri Torr................. A

247. *Polygonatum* Tourn.

405. P. biflorum Ell................. B
406. P. giganteum Dietrich........... C

248. *Asparagus* Tourn.

407. A. officinalis L................. K
Escaping from gardens.

249. *Erythronium* L.

408. E. albidum Nutt .... A, B, C, and G

LXXI.—COMMELYNACEÆ.

250. *Tradescantia* L.

409. T. virginica L .... A and I

LXXII.—JUNCACEÆ.

251. *Juncus* Tourn.

410. J. tenuis Willd..... .... A

LXXIII.—TYPHACEÆ.

252. *Typha* Tourn.

411. T. latifolia L. Marsh, 1½ miles east of Ottawa.

LXXIV.—ARACEÆ.

253. *Arisæma* Martius.

412. A. triphyllum Torr .... B
413. A. dracontium Schott .... B

LXXV.—ALISMACEÆ.

254. *Alisma* L.

414. A. plantago L................ B

255. *Sagittaria* L.

415. S. variabilis Engl. Reported from Wellsville.

LXXVI.—GRAMINEÆ.

256. *Spartina* Schreber.

416. S. cynosuroides Willd .... A

257. *Panicum* L.

417. P. sanguinale L .... K
418. P. proliferum Lam .... D
419. P. capillare L................. A
420. P. virgatum L................. A
421. P. clandestinum L .... B
422. P. depauperatum Muhl.......... A
423. P. crus-galli L .... B

258. *Setaria* Beauv.

424. S. glauca Beauv ....Everywhere
425. S. viridis Beauv ....Everywhere

259. *Leersia* Swartz.

426. L. virginica Willd.............. B

260. *Andropogon* Royen.

427. A. furcatus Muhl............... A

261. *Chrysopogon* Trin.

428. C. nutans Benth................ A

262. *Phalaris* L.

429. P. arundinacea L.

263. *Aristida* L.

430. A. oligantha Mx.

264. *Muhlenbergia* Schreber.

431. M. diffusa Schreber.

265. *Phleum* L.

432. P. pratense L ....Everywhere

266. *Alopecurus* L.

433. A. geniculatus L..........F and B

267. *Cinna* L.

434. C. arundinacea L.

268. *Bouteloua* Lagasca.

435. B. oligostachya Torr .... A
436. B. racemosa Lag .... A

269. *Eleusine* Gaertn.

437. E. indica Gaertn .... K

270. *Triodia* R. Br.

438. T. cuprea Jacq.

271. *Eragrostis* Beauv.

439. E. major Host.................. K
440. E. pectinacea Gr..........A and K

272. *Melica* L.

441. M. diffusa Pursh.

273. *Uniola* L.

442. U. latifolia Mx................. D

274. *Poa* L.

443. P. compressa L .... B
444. P. pratensis L.....Fields, common

275. *Bromus* L.

445. B. secalinus L.........Wheat fields

276. *Elymus* L.

446. E. virginicus L .... B
447. E. canadensis L................ C

LXXVII.—FILICES.

277. *Notholæna* R. Br.

448. N. dealbata Kunze .... B

278. *Pellæa* Link.

449. P. atropurpurea Link........... B

279. *Camptosorus* Link.

450. C. rhizophyllus Link............ B

280. *Cystopteris* Bernh.

451. C. fragilis Bernh................ B

LXXVIII.—OPHIOGLOSSACEÆ.

281. *Botrychium* Swartz.

452. B. virginianum Swartz.......... B

THE RELATIONS OF THE COMPOSITE FLORA OF KANSAS.

A. S. HITCHCOCK, MANHATTAN.

The flora of Kansas is essentially that of the plains, though the Mississippi valley flora mingles to a very perceptible degree in the extreme east. In studying the relations of the Kansas flora, the order Compositæ was selected as being better suited to represent these relations than any other order, or group of orders, comprising an equal number of genera. The Compositæ are widely distributed over the whole world.

They are found in all climates, in all soils, and at all altitudes. It is thought, therefore, that the conclusions reached in regard to Compositæ will be fairly applicable to the whole flora of Kansas, and what is true of Kansas in this respect is probably equally true of the plains to the south and north for several hundred miles.

The 62 genera which I know to be represented in Kansas have been arranged in the table given below. In column 1, are the genera; in column 2, are checked those which occur in Mexico; in column 3, those which occur in the region east of the Mississippi river and north of Kentucky and Virginia; in column 4, those found in our southern flora, from the above region to the Gulf; in column 5, those occurring in the Rocky Mountains; in column 6, those found in Mexico and throughout the United States; in column 7, those found on the plains, and would include those which are not confined to the eastern fourth of the State

	Mexico	*N. E. U. S.*	*S. E. U. S.*	*Rocky Mts.*	*Mex. & U. S.*	*Plains*		*Mexico*	*N. E. U. S.*	*S. E. U. S.*	*Rocky Mts.*	*Mex. & U. S.*	*Plains*
Elephantopus	X	X	X				Rudbeckia		X	X	X		X
Vernonia	X	X	X			X	Lepachys		X	X			X
Eupatorium					X		Helianthus					X	
Kuhnia	X	X	X			X	Verbesina	X	X	X			
Liatris	X	X	X			X	Actinomeris	X	X	X			
Gutierrezia	X					X	Coreopsis	X	X	X			X
Amphiachyris	X					X	Bidens	X	X	X			X
Grindelia	X					X	Thelesperma	X					X
Heterotheca	X		X			X	Marshallia			X			X
Chrysopsis					X		Bahia	X			X		X
Aplopappus	X					X	Hymenopappus	X		X			X
Solidago					X		Actinella	X			X		X
Aphanostephus	X					X	Helenium	X	X	X			X
Boltonia		X	X				Gaillardia	X		X			X
Townsendia				X		X	Dysodia	X					X
Aster					X		Anthemis[1]						
Erigeron					X		Achillea[2]						
Evax	X					X	Artemisia					X	
Antennaria[2]							Senecio					X	
Gnaphalium					X		Cacalia		X	X			
Polymnia	X	X	X				Erechtites	X	X	X			X
Silphium		X	X			X	Arctium[1]						
Engelmannia	X					X	Cnicus					X	
Iva	X	X	X			X	Hieracium[2]						
Ambrosia					X		Prenanthes[2]						
Franseria	X			X		X	Lygodesmia				X		X
Xanthium[1]							Troximon						X
Eclipta	X	X	X				Taraxacum[2]						
Zinnia	X					X	Pyrrhopappus	X		X			X
Heliopsis	X	X	X			X	Lactuca		X	X			
Echinacea		X	X			X	Sonchus[1]						

The four genera marked ([1]) are introduced. These, together with the following 11 genera, which are found widely distributed throughout the United States and into Mexico, or even as far south as Chili, can be disregarded in the present discussion: Eupatorium, Chrysopsis, Solidago, Aster, Erigeron, Ambrosia, Helianthus, Artemisia, Senecio, Cnicus, and Gnaphalium. At least two of these, Artemisia and Gnaphalium, are probably southern extensions of northern forms.

The following are Rocky Mountain genera, not extending east of the plains: Townsendia, Franseria, Bahia, Actinella, Lygodesmia, and Troximon. Three of these also extend into Mexico.

Five genera, marked ([2]) in the list, are of wide northern distribution, and extend southward along the mountains or through eastern United States: Antennaria, Achillea, Hieracium, Prenanthes, and Taraxacum.

There is no genus common to Kansas and the northeast region which is not also found in the southeast region.

Of the eastern genera, seven extend into Kansas but do not reach Mexico: Boltonia, Silphium, Echinacea, Lepachys, Cacalia, Lactuca, and Rudbeckia. The latter extends into the Rocky Mountains. These genera are but sparsely represented on the plains, being found in Kansas mostly in the eastern part.

Fifteen Eastern genera extend into Mexico, but not west of the plains: Elephantopus, Vernonia, Kuhnia, Liatris, Heterotheca, Polymnia, Iva, Eclipta, Heliopsis, Verbesina, Actinomeris, Coreopsis, Bidens, Helenium, and Erechtites.

Four genera of the southeast region extend as far north as Kansas, and all but the first also into Mexico: Marshallia, Hymenopappus, Gaillardia, and Pyrrhopappus.

Ten genera are common to Mexico and the plains, but are not found in the other regions. These 10 genera, many of which are not found north of Kansas, throw much light on the relation of the Kansas flora. These genera are: Gutierrezia, Amphiachyris, Grindelia, Aplopappus, Aphanostephus, Evax, Engelmannia, Zinnia, Thelesperma, and Dysodia.

This relation is shown in a different form by the following summary of the 47 genera under consideration:

Common to Kansas and Mexico, 31 genera.

Common to Kansas and northeast region, 23 genera.

Common to Kansas and southeast region, 28 genera.

Common to Kansas and Rocky Mountains, 8 genera.

We see from these tabulations that our flora has more in common with Mexico than any other region. Ten genera have extended only along the plains; three, also, into the Rocky Mountains; three along the plains and into the southeast region; 15 have spread more or less throughout eastern North America. Geographically, Kansas is much more closely related to the portion of the United States east of the Mississippi than it is to Mexico, yet we have only seven genera common only to the two former, while we have 10 common only to Kansas and Mexico. The small number of northern and mountain genera is also very noticeable.

This relation of the Kansas flora to the Mexican is undoubtedly closely connected with the receding of the glacial epoch. As the arctic forms withdrew northward or into the mountains, their place was taken by forms from the south. As was pointed out by Doctor Watson (Proc. A. A. A. S., vol. XXXIX), the Mexican flora is more closely related to not only the plains, but the whole Atlantic region, than to the Pacific or Great Basin regions. Doctor Britton (l. c.) arrives at the same result by a tabulation of the orders of phanerogams.

SOME NOTES ON CONDENSED VEGETATION IN WESTERN KANSAS.

BY MINNIE REED, MANHATTAN, KAS.

It is a well-known fact that the geographical position of a plant determines its habits and peculiarities of appearance; that is, we expect to see a certain kind of vegetation in the tropics, another in the temperate zone, and still another in the frigid, just as we expect to see different races or types of the human family in the different zones. This variation of plants in different localities of the same zone is almost as striking in some instances, and often plants belonging in the same family, or even the same genus, are frequently so different in appearance as to be almost unrecognized by the amateur botanist.

Take, for instance, the mountain and valley flora, or those of the swamp and arid, dry region, and compare them. Though these may all grow in the same latitude, or even in the same State and county, they are so different as to be noticed immediately by the very casual observer, while a botanist would be able to tell at once where the plant grew — in a dry or a moist situation.

It is because of this fact that we associate the stately palms, the graceful tree ferns and the magnificent Victoria regias with the hot, moist climate of the tropics. For the same reason, we associate deciduous trees, like the oak, elm, or hickory, the dainty ferns and the fair, sweet water lilies of our own ponds, with the temperate zone; or the pines, ferns, hemlocks and balsams with the colder parts of this zone. If our imagination travels further and further northward, we think of the scant vegetation of mosses and lichens, or the great fields of perpetual ice and snow, covered with microscopic plant forms only.

All these things point out and verify the law of the survival of the fittest: for we know that the great, large-leaved, succulent plants of the south, with their tender, naked buds, could not live where there was ice and snow. Nor would you expect to find the vegetation of the warm, moist tropical regions so small, or the buds of trees so carefully protected from frost and cold by varnished or wooly scales, when there is no frost or snow.

Every part of a plant has some use, and every peculiarity some advantage, so that we could not expect any modified part for protection, when there is no need for that protection.

Thus, after years of evolution, (or adaptation, if you are pleased so to call it.) the flora of each region has come into harmony with its environments, and we have a type of plants best suited to their habitation.

With these general principles in mind, we would scarcely expect to find any large, thin-leaved plants out in the dry, arid regions of western Kansas. It is the absence of these that perhaps impresses us most when we first become acquainted with the flora of this section.

Looking across the level prairies of Greeley county, everything seems to be a dull, monotonous, grayish-green hue, instead of the vivid fresh green of our prairies in eastern Kansas. Again, if we notice, the prevailing color of the flowers is yellow, with a few dull, purplish-red ones intermixed. In fact, we are forcibly reminded of our own autumn colors, though these are midsummer flowers. Are these colors due to the higher altitude, dry climate, or the very cool nights, or to all three combined?

If we study more closely, we will notice that most of the plants are Compositæ, which are usually yellow or purplish, while the grayish tint of the prairies is largely due to the hairiness of the leaves, as most plants are more or less hairy, scabrous or resinous in this region. Indeed, one rarely finds a glabrous, thin-leaved plant, and that is usually resinous or viscid. One will also find the leaves of almost every plant either finely divided or very much reduced, many being very narrowly linear, subulate, or even simple scales and spines. In fact, the whole plant is reduced, and often less than one-fourth the size of sister species in the eastern part of our State.

The fierce struggle for moisture is everywhere apparent, from the size and form of the plants. Of course, that plant that can endure the burning sun and the hot winds longest has the greatest advantage, thrives best, and usually crowds out its less hardy companions that are unable to fit themselves so well to their environments.

The following plants are the most noticeably condensed of the western Kansas flora, and form very strong contrasts with Eastern species:

First, in the order Cruciferæ, instead of our ordinary Nasturtium sinuatum Nutt. Sisymbrium canescens Nutt., and S. officinale Scop., we find there only two species abundant, and both very pale, with reduced, finely-divided foliage. These two species are Erysimum parviflorum Nutt. and Lepidium virginicum L., the former almost leafless in the extreme western counties; the latter very small, many times scarcely four inches high.

Our common purslane, Portulaca oleracea L. (an introduced species), with its thick, fleshy branches and leaves (a single plant often being over three feet in diameter), is replaced in this dry region by the tiny, hairy Portulaca pilosa L., which is less than four inches in diameter.

In the order Malvaceæ, or mallow family, we have in eastern Kansas Abutilon avicennæ Gaertn, (which, though introduced, is very abundant in our meadows,) also Hibiscus militaris Cav. and Callirrhoe involucrata, all of which are from one to four feet high. These are replaced in the West by a single species, Malvastrum coccineum Gr., which is seldom more than six inches high, and has small-lobed, thick, hairy leaves, and grows procumbent instead of upright, as most of the Eastern species.

The Western Linaceæ are Linum sulcatum Ridd. and Linum rigidum Pursh.; the former from 1 foot to 1½ feet tall, very slender, with very few narrow leaves, while the latter is scarcely three inches tall, very bushy and scraggy, and also quite rigid, the leaves being almost subulate.

The Leguminosæ are represented by such plants as Dalea aurea Nutt. and Dalea laxiflora; the first covered with long, silky hairs, and very few small, pinnate leaves; the latter rather tall, but slender, with small leaves, and numerous branches near the top. Also, Psoralea argophylla Ph., and P. tenuiflora Ph., besides several fine-leaved or hairy Astragali. Astragalus bisulcatus Gr., A. pectinatus Dougl., A. flexuosus and A. macrolobus having fine foliage, and Astragalus mollissimus Torr. with rather large leaves, but very hairy.

Our common evening primroses, of the order Onagraceæ, are entirely replaced by hairy, grayish-colored, narrow-leaved, dwarfed species, most of them less than a foot high, and most of them but three or four inches. The species found in this dry region are: Œnothera triloba Nutt., Œnothera fremontii Watson, Œ. hartwegi Benth., Œ. pinnatifida Nutt., and the beautiful little Œnothera canescens Torr., which grows flat on the ground and has such dainty pink, variegated blossoms, as fragrant as violets. In this same order, also, is found Gaura coccinea Nutt., which is very abundant in cultivated portions of this dry region. This plant is usually not more than six inches high.

The most striking example of condensed vegetation is seen in the order Cactaceæ, which is represented in western Kansas by three or four genera. In this order the leaves are reduced to spines, or minute scales, while the thick, fleshy stems contain chlorophyll, and the epidermis is furnished with stomata, so that they perform the functions of leaves. Common species of this order are: Opuntia missouriensis DC., O. rafinesquii Eng., O. arborescens, of the prickly-pear family; and Mamillaria vivipara Haw., M. missouriensis DC., and M. dasyacantha, of the ordinary round species. These vary in size from scarcely an inch in diameter, in some of the Mamillaria, to 10 or 15 inches in length, in the prickly-pear family.

The order Compositæ is most fully represented in that region, yet most of these are the typical grayish, hairy, narrow-leaved plants peculiar to the Western flora.

Liatris squarrosa Willd., very common there, is from 6 to 12 inches high, rigid and glabrous, while our L. punctata, and L. spicata Willd., and others common here, are from one to five feet in height, and proportionately larger.

Aplopappus spinulosus DC., a grayish, scabrous plant, with deeply serrate, lanceolate leaves, is a composite, as common as the sunflower here, though very much smaller, seldom exceeding six inches in height.

Thelesperma gracile Gr. and Hymenopappus tenuifolius Pursh., both slender plants, with very few pinnatifid, hairy leaves, are also quite common there.

The asters there all have fine foliage, and either hairy or viscid. Aster multiflorus Ait., A. ericæfolius, and A. tanacetifolius HBK., are the chief representatives. The first two have almost subulate leaves, rigid and thick, and the entire plant from 3 to 10 inches high, contrasting very strongly with our Eastern asters, from one foot to six feet tall, as A. salicifolius Ait., A. paniculatus Lam., and A. cordifolius, all of which have very thin, smooth leaves.

Our common Echinacea purpurea Moench is replaced by E. augustifolia DC., which is densely hirsute, and from three to six inches tall.

The Helianthi are usually about one-half as tall as ours in eastern Kansas. I collected many specimens of Helianthus annuus L., in blossom, that were scarcely six inches tall, and proportionately small.

Another Compositæ is the Lepachys columnaris Torr. & Gray, and its variety pulcherrima Torr. & Gray and L. tagetes Gr. Both have thick, slightly viscid, pinnatifid leaves. The variety pulcherrima is not very common, being comparatively rare. while the other two are very abundant, taking the place of our L. pinnata Torr. & Gray.

Baccharis wrightii is another example of almost leafless plant, the leaves being almost spines, subulate, short, and rigid, while Lygodesmia juncea Don. is perhaps the most striking example of all, or at least in the order Compositæ. This plant somewhat resembles a common rush, but is rather diffusely branched, entirely destitute of foliage, bearing a small pink flower on the tip of each stiff branch, which look very odd on such a naked plant.

The order Asclepiadaceæ is represented by the two extremes: the little, narrow-leaved Asclepias verticillata Gr., var. pumila Gr., from three to eight inches tall, and the large-leaved, rather tall species, Asclepias jamesii.

In Boraginaceæ, there is Krynitzkia jamesii, scarcely six inches high, very hairy, and gray, with a spiny fruit.

The Solanums are S. rostratum, common here, and S. triflorum, with finer, smooth foliage.

The Penstemons are P. albidus Nutt. and P. gracile Nutt., both about six inches tall; while our common P. grandiflora Nutt. and P. tubiflorus Nutt. are from one to three feet. Our common Plantago major L. is entirely replaced by the little gray, hairy species, P. patagonica, varieties gnaphalioides and aristata, from two to six inches, with narrow, grass-like, hairy leaves.

The order Nyctaginaceæ is represented by Oxybaphus angustifolius Sweet, also narrow-leafed, slender, and seldom ever more than a foot tall. Our O. nyctagineus Sweet often exceeds three feet, and has oval leaves.

In the order Illecebraceæ, there is the whitish plant, scarcely three inches high, called Paronychia sessiliflora. Its white appearance is due principally to the silvery, scarious bracts, which equal or exceed the short, narrow leaves. It grows in close mats in the gypsum banks, being almost the same color.

In Chenopodiaceæ is found the ordinary Chenopodium album L., though somewhat reduced in size, and smaller foliage, and Cycloloma platyphyllum Moq., and Corispermum hyssopifolium L., both with reduced foliage, almost scale like, or spines. The Cycloloma is hairy, the Corispermum coriaceous, and but a few inches high.

The order Gramineæ is well represented in this region, as well as farther east, but they are rigid and wiry, and have the characteristic dull, grayish color.

Of course, the buffalo grass, Buchloe dactyloides Englm., is the most common.

Its short, bunchy manner of growth and monotonous gray tone are familiar to every one who has been across the plains.

Aristida purpurea Nutt., Bontelona racemosa, B. hirsuta, B. oligostachya Torr., Schedonnardus texanus Steud., and Munroa squarrosa Torr., are all very common on the prairie, and many of them somewhat hairy or scabrous.

There might be a great number of others added to this list, to illustrate the general tendency of Western plants towards condensation of both leaf and stem, but these amply illustrate this peculiar feature of the flora of a dry, arid region.

The question that immediately occurs to the mind is: of what advantage are all these peculiarities to a plant? Perhaps the first answer to occur to you is that insufficient moisture and poor soil will naturally produce dwarfed or stunted plants. Yet this does not explain either hairiness, or narrow foliage, or resinous coatings.

There are five or six peculiarities to be explained in these condensed plants, all interesting, and all explainable more or less satisfactorily.

From the above comparisons of Eastern and Western species, the following peculiarities have no doubt been noticed: Their reduced size; their hairy, wooly or resinous covering; their rigidity and their finely-divided foliage; and the entire absence of leaves on some of the plants.

Aside from the dwarfing effect of drouth, there must be a reason why these peculiarities are so strongly developed. Sir John Lubbock says every leaf form and every special modification of any part has some special purpose or advantage for the plant.

This consolidation or condensation of plants, by shortening stems, thickening leaves, or the substitution of fleshy, solid plants without foliage, of course reduces the surface for evaporating moisture, and respiration and transpiration both take place more slowly. Compare an ordinary prickly-pear cactus with any leafy weed, like the Chenopodium, for instance, and note the vast difference between them in the amount of surface exposed to sun and air for evaporation.

This reduction of surface for evaporation or transpiration is the chief advantage in the consolidation of the cacti in such a compact form, while the spines and prickles protect them from the grazing animals that roam over this section devouring every green herb. The rigidity and hardness of some other species probably serve the same purpose.

The hairy or resinous covering of leaves and stems forms protecting covers for the stomata, preventing too rapid transpiration.

The advantages of narrow or finely-divided foliage may be more than one, and are so easily explained. Sir John Lubbock says, in his lecture on leaves, that large, thin leaves are usually found in moist regions, protected from strong winds. Mrs. W. A. Kellerman suggested this point in a paper ("The Evolution of Leaves") read before the Academy several years ago. The point suggested by these two writers gives us the clue to the explanation of the finely-divided foliage of this dry, windy region. It has been previously stated that large, thin leaves are easily injured by strong winds passing through them, while thinly-divided, rigid leaves would allow the passage of the wind freely, without any injury to the foliage. The winds are very strong and constant in all, this dry region; hence the need of the finely-divided or linear foliage.

There is still another means of reducing evaporation that occurred to me while studying these Western plants. Might we not most naturally expect smaller stomata, more deeply imbedded, and a small ernumber per square inch of surface, on Western plants than on our Eastern species, growing in a more moist climate? Thinking this most probably the case, I began immediately to measure and compare stomata on plants from both West and East, taking those of the same species or genus for comparison.

I have not yet completed a tabulated list of 100 specimens. so cannot as yet give my figures or draw definite conclusions. The results thus far seem somewhat confusing, but I am still inclined to think they will verify my supposition, for I find the stomata not only more distant, but somewhat smaller, on Western plants. When I have finished measuring and comparing my list of plants, I can draw more definite conclusions.

Other interesting things in regard to stomata were also noticed in my study. Almost every narrow-leafed plant studied had stomata on both surfaces of the leaf, as well as on the stem. The grasses and parallel-veined leaves have long, narrow stomata, arranged with their major axis parallel to the major axis of the leaf, while the stomata of the net-veined leaves seemed to be scattered irregularly over the surface, regardless of the axis, and somewhat broader than those of the narrow leaves. When there was any difference between the stomata of the upper and under surfaces, those on the lower were broader, in many cases being almost round.

This subject is very interesting, and there is much yet to be learned about stomates, their arrangement, distribution, and size, and their connection with the habits or location of various plants. This subject may have been well studied, but if it has been I am unable to find any literature on the subject. This study is very fascinating, so that any botanist cannot help enjoying it or discovering new facts.

It is to be hoped that other botanists will study the peculiarly Western types of our Kansas flora, and add something definite to our knowledge of their habits, structure, and forms.

ADDITIONS TO THE FLORA OF KANSAS.

BY B. B. SMYTH, TOPEKA.

The following species and varieties of plants, not heretofore reported, have been found growing within the State during the past two years, and are therefore added to the list of Kansas plants. Descriptions are given, as far as possible, of all plants not described in Gray's Manual (6th edition), or Coulter's Manual of Rocky Mountain Botany. Many of the descriptions are obtained from Coulter's Manual of the Phanerogams and Pteridophytes of Western Texas, being Contributions from the United States National Herbarium, vol. II. Descriptions of some of the plants are not at hand, and their existence in the State, though here reported, is not absolutely certain.

FLOWERING PLANTS.

1. Anemone patens L.: Linn county (Mrs. A. H. Merrell).

2. Delphinium carolinianum Walter: Stems 3 to 6 dm. high, slender, often softly pubescent; leaves deeply 3- to 5-parted, the divisions two to three times cleft; the lobes all narrowly linear; raceme strict; flowers whitish; spur ascending; pods erect. Frequent on rocky hillsides; our most common delphinium; heretofore known as D. azureum Mx. (Smyth).

3. Delphinium scopulorum Gray: Pottawatomie county (collected by F. F. Crevecœur, and determined by Prof. L. H. Dewey).

4. Draba caroliniana Walt., var. micrantha Gray: Franklin county (collected by Prof. W. E. Castle).

5. Erysimum asperum DC., var. arkansanum Gray: Sherman, Wallace, Finney and Hamilton counties (S.)

6. Nasturtium sphærocarpum Gray: Ford county (Contributions from the U. S. National Herbarium, vol. I, p. 202).

7. Lechea tenuifolia Mx.: Stafford county (Cont. Nat. Herb., vol. I, p. 202).

8. Viola hastata Mx.: Pottawatomie county (collected by F. F. Crevecœur, Onaga, and determined by Prof. L. H. Dewey).

9. Viola lanceolata L.: Northeastern Kansas.

10. Ionidium polygalæfolium Dent.: Sumner county.

11. Arenaria michauxii Hook. fr.: Northern and northwestern Kansas; frequent in rocky and chalky bluffs (Smyth & Harshbarger).

12. Gypsophila muralis L.: Sherman county; escaped from garden (S.)

13. Lychnis githago L.: Shawnee and Pottawatomie counties; in wheat fields (S.)

14. Stellaria media Smith: Franklin county, garden (Professor Castle).

15. Mollugo verticillata L.: Reno and Pratt counties (S.)

16. Oxalis violacea L., forma alba: Doniphan county (Minnie Blake); Franklin county (Castle).

17. Ptelea trifoliata L., var. mollis T. & G.: Labette county (Dr. W. S. Newlon).

18. Ilex decidua Walt.: Sumner county (S.)

—. Berchemia scandens Trelease (*B. volubilis* DC.): Cherokee county.

19. Tribulus maximus L.: Wallace and Hamilton counties (S.)

20. Vitis novo-mexicana Munson: Montgomery, Barber and Hamilton counties (Prof. A. S. Hitchcock, Manhattan).

21. Æsculus arguta Buckley: Shrub 9 to 15 dm. high; leaflets 7, narrowly lanceolate, mostly long acuminate, glabrous, sharply serrate, 5 to 10 cm. long; stamens erect or slightly curved, much longer than the pale yellow corolla; flowers sometimes in dense, often in loose, inflorescence; fruit covered with prickles when young. Southeastern Kansas, along streams (S.)

22. Krameria secundiflora DC.: A decumbent, silky villous herb, ligneous only at base; leaves narrowly linear (or the lower cauline ones oblong lanceolate or obovate lanceolate), about 18 mm. long, those of the branches usually longer; peduncles 2-bracted; sepals ovate lanceolate, nearly equal; fruit armed with stout and straight retrorsely-scabrous spines. Morton county (Cont. Nat. Herb., vol. I, p. 203).

23. Amorpha microphylla Pursh: Rooks county (Bartholomew); Phillips and Pratt counties (S.)

24. Astragalus gracilis Nutt.: Norton and Sherman counties (Smyth & Harshbarger).

25. Astragalus lotiflorus Hook., var. brachypus Gray: Pawnee and Ford counties (Cont. Nat. Herb. vol. I, p. 204).

26. Astragalus pictus Gray: Sherman and Cheyenne counties (S.)

27. Astragalus pictus, var. filifolius Gray: Hamilton county (Smyth); southwest Kansas (Carleton in Cont. Nat. Herb., vol. I, p. 227).

28. Astragalus purshii Dougl.: Rooks county (Bartholomew).

29. Dalea nana Torr.: Like D. aurea, but low, 10 to 15 cm. high, diffusely spreading, repeatedly branched, and leafy to the spikes; spikes small, on very short peduncles; flowers yellow; bracts as long as the calyx. Seward and Stevens counties (Cont. Nat. Herb., vol. I. p. 204).

30. Dalea rubescens Wats.: Seward county (S.)

31. Gleditschia triacanthos L., thornless form: Rooks county (Barth.); Topeka, Manhattan (S.)

32. Hoffmanseggia falcaria Cav., var. stricta E. M. Fisher, *n. v.*: Erect, 10 to 30 cm. high; stipules obtuse, villous on margin; peduncles long, bearing a loose raceme of suberect flowers; sepals obtuse; vexillum with claw usually more dilated; pod

long, usually on spreading pedicels; seeds 6 to 9. From Kansas southwestward. Collected in Kansas in 1867, by Doctor Bell; determined and named in 1892 by E. M. Fisher. Type in Gray Herbarium. (Cont. Nat. Herb., vol. I, p. 144.)

33. Hoffmanseggia jamesii Torr. & Gray, var. popenoensis Fisher, *n. v.:* Herbaceous, taller, with thick stems; upper stems and flowers black with large glands; pinnæ 7 to 9; leaflets more glandular; racemes denser; petals with villous veins; filaments larger, more villous. Collected in Kansas in 1876 by Prof. E. A. Popenoe, and named in 1892 by Mr. Fisher, as above. Type in National Herbarium. (Cont. Nat. Herb., vol. I, p. 150.)

34. Hosackia purshiana Benth., forma orientata: Plants 4 to 10 dm. high; branches north and south; leaves east and west, facing the sun all day; pods many, 40 to 300 on a plant. Pawnee, Barton, Reno and Stafford counties, on rich soil (S.)

35. Hosackia purshiana, var. pusilla: Plants 1 dm. high, scarcely branched; pods few, seldom exceeding three. Common in western Kansas (S.)

36. Indigofera leptosepala Nutt.: Norton, Wallace and Meade counties (S.)

37. Lespedeza striata L.: Franklin county, introduced (Castle).

38. Oxytropis monticola Gray: Kingman county (Carleton in Cont. Nat. Herb., vol. I, p. 222).

39. Oxytropis splendens Dougl.: Rooks county (Bartholomew).

40. Psoralea tenuiflora Pursh: West of 99th meridian. This is very distinct from P. floribunda Nutt., of eastern Kansas, which has of late years been catalogued as P. tenuiflora (S.)

41. Cerasus pumila Mx.: Phillips and Graham counties.

42. Geum vernum T. & G.: Franklin county (Castle).

43. Pyrus ioensis Bailey, *n. sp.:* Northeastern Kansas (Amer. Gard. XII, 473).

44. Ammannia auriculata Willd.: Rooks county (Bartholomew).

45. Gaura drummondii Torr. & Gray: Stem suffruticose at base, a little hairy below, virgately branched above; leaves somewhat canescently puberulent, lanceolate, acute, denticulate or somewhat sinuate; spikes slender, few and loosely flowered; fruit sessile, very abruptly narrowed at the base and terete when mature, ovate-pyramidal above, acute, with four strong carinate angles. Kiowa and Seward counties (S.)

46. Gaura sinuata Nutt.: Stem suffruticose, diffuse or decumbent, branching and very leafy at base, sending off slender and naked flowering branches, glabrous or hairy; leaves lanceolate linear, acute, remotely and acutely sinuate-toothed, glabrous; flowers loose, pediceled; fruit lanceolate or ovate, tapering at both ends. Seward county (S.)

47. Gaura villosa Torr.: Stems suffruticose, and with numerous very short, leafy branches at base, canescently puberulent, with villous hairs intermixed, and sending up naked and elongated glabrous and often paniculate flowering branches; leaves tomentose-canescent on both sides, lanceolate, remotely and acutely toothed or rarely entire; raceme loosely flowered; fruit slender, 4-sided, tapering at both ends, on a filiform pedicel, at length relaxed. Cimarron valley, Seward county (S.)

48. Œnothera hartwegi Benth.: Sherman and Meade counties (Smyth); Clark county (Cont. Nat. Herb., vol. I, p. 206).

49. Œnothera sinuata L., var. grandiflora Watson. Edwards county (Cont. Nat. Herb., vol. I, p. 206).

50. Mamillaria dasyacantha Eng.: Simple, nearly globose, 3.5 to 6.5 cm. high; tubercles terete, loosely arranged, slightly grooved, 8 to 10 mm. long, with somewhat villous axils; spines straight, more slender and soft than usual, often capillary, spreading, but not radiating, 12 to 24 mm. long, the exterior 25 to 35 white, the in-

terior 7 to 13 dusky-purple and longer; central spine single, erect, often wanting; berry central, ovate. Kingman county (Cont. Nat. Herb., vol. I, p. 207).

51. Sesuvium portulacastrum L.: Frequent in Kansas salt marshes (M. A. Carleton in Cont. Nat. Herb.. vol. I, p. 232).

52. Cornus asperifolia Mx., var. drummondii Vasey: Pottawatomie county (Crevecœur).

53. Actinella acaulis Nutt.: Hamilton and Meade counties (S).

54. Actinella scaposa Nutt.: Sherman, Hamilton, Meade and Morton counties (S).

55. Artemisia filifolia Torr.: From Sherman to Barber county, and westward (S).

56. Artemisia frigida Willd.: Stems herbaceous, 1 to 5 dm. high, simple or slightly branched, in tufts from a woody base, very leafy, silky-canescent, or silvery; leaves twice ternately or quinately parted, the divisions narrowly linear; heads globose, racemose, 4 mm. diam.; flowers all fertile, marginal ones pistillate, corollas glabrous. Meade county, north and west.

57. Artemisia wrightii Gray: Rooks county (Bartholomew); Sherman, Finney, Kingman and Kiowa counties (Smyth); Meade county (Cont. Nat. Herb. vol. I, p. 209).

58. Baccharis wrightii Gray: Greeley county (Minnie Reed); Clark county (Cont. Nat. Herb. vol. I, p. 208).

59. Berlandiera lyrata Benth.: Stems low, with long, single-headed peduncles, the later from leafy stems or branches; canescent, with minute white or gray tomentum; leaves at length greenish above, variously lyrate-pinnatifid, attenuate at base; the lateral lobes oblong or narrower, obtusely dentate, sometimes incised; achenes obovate, the costa of the inner face strongly carinate. Morton county (Cont. Nat. Herb., vol. I, p. 208).

60. Cnicus undulatus, var. megacephalus Gray: Norton and Decatur counties (Smyth); Reno county (Cont. Nat. Herb., vol. I, p. 209).

61. Eupatorium hyssopifolium L.: Kansas City, Kas. (Cont. Nat. Herb., vol. I, p. 207). Probably recently introduced.

62. Franseria discolor Nutt.: Wallace and Seward counties (S).

63. Franseria tomentosa Gray: Along Arkansas and Cimarron rivers, southwest Kansas (S).

64. Gaillardia pulchella Foug.: Annual, hirsute, 3 to 5 dm. high; leaves from entire to pinnatifid; rays two-colored, lower part red-purple or darker, the upper or teeth yellow, at most 2.5 cm. long; chaff rather stout, hardly surpassing the mature achenes. From Norton to Barber county and west; common in spots on rich prairies (S).

—. Gutierrezia sarothræ Britton & Rusby (*G. euthamiæ* T. & G.): Common on rocky hills of western Kansas.

65. Gutierrezia texana T. & G.: Sumner county (S).

66. Haploesthes greggii Gray: Seward county, in alkaline lands (S).

67. Hymenopappus flavescens Gray: Stems leafy, densely white tomentose; leaves from pinnatifid to bipinnately parted, divisions narrowly to broadly linear; heads 8 to 10 mm. high; involucral bracts roundish obovate to ovate, with greenish-white or yellowish margins; achenes rather short villous; pappus of conspicuous spatulate 1-nerved scales. Common in southwest Kansas (Carleton in Cont. Nat. Herb., vol. I, p. 209.)

68. Krigia virginica Willd.: Shawnee county (Harshbarger).

69. Lactuca scariola L.: All through the State as far west as Sherman county; introduced within three years, and rapidly taking possession of dry places along the railroads (Smyth).

70. Lepachys tagetes L.: Common on rocky hills and dry ground west of 99° (S.)

71. Lepachys tagetes L., yellow-rayed form: Sherman county (Smyth & Harshbarger); Seward county (Carleton).

72. Melampodium cinereum DC.: Kiowa, Haskell and Meade counties (Smyth); Seward and Morton counties (Cont. Nat. Herb., vol. I, p. 208).

73. Polypteris texana Gray: Rather stout; leaves from lanceolate-linear to lanceolate-oblong, distinctly petioled; involucre 20- to 30-flowered, rayless, 6 to 10 mm. high, of spatulate-oblong bracts; pappus scales oblong-ovate to oblong-lanceolate, with slender, nearly complete or slightly excurrent costæ. Stevens and Morton counties (Cont. Nat. Herb., vol. I, p. 209).

74. Thelesperma filifolia Gray: Loosely branching and leafy; leaves not rigid, bipinnately divided into filiform lobes no wider than the rhachis; bracts of outer involucre 8, subulate linear, equaling or more than half as long as the inner, which are connate only to the middle; rays broad, over 12 mm. long; disk usually purple; pappus scales stout, triangular-subulate, not longer than the width of the achenes. Stafford and Kiowa counties (S.)

75. Samolus valerandi L.: Seward county (S).

76. Phlox paniculata L.: Pottawatomie county (Crevecœur, citing L. H. Dewey).

77. Lycopsis arvensis L.: Franklin county, one place, introduced (Castle).

78. Convolvulus incanus Vahl.: Morton county (Cont. Nat. Herb., vol. I, p. 212).

79. Ipomœa commutata Roem. & Schult.: Arkansas City (Cont. Nat. Herb., vol. I, p. 211).

80. Chamæsaracha sordida Gray: Wichita county, Garden City, and Arkalon, and westward, in barren flats (S).

81. Physalis hederæfolia Gray: Comanche and Clark counties (Cont. Nat. Herb., vol. I, p. 212).

82. Physalis virginiana Mills, var. ambigua Gray: Franklin county (Castle).

83. Mimulus glabratus HBK., var. jamesii Gray: Stafford county (Cont. Nat. Herb., vol. I, p. 212).

84. Pentstemon jamesii Benth.: Rooks county (Bartholomew).

85. Veronica scutellata L.: Rooks county (Bartholomew).

86. Aphyllon ludovicianum Gray: Norton, Decatur and Sherman counties (Smyth & Harshbarger); Comanche county (Cont. Nat. Herb., vol. I, p. 213).

87. Calamintha nuttallii Gray: Riley county.

88. Lycopus angustifolius Nutt.: Shawnee county (S.)

89. Scutellaria wrightii Gray: Franklin county (Castle).

90. Plantago patagonica Jacq., var. spinulosa Gray: Norton county.

91. Oxybaphus nyctagineus Sweet, var. pilosus Gray: Barber county (Cont. Nat. Herb., vol. I. p. 213).

92. Amarantus palmeri Wats.: Rooks county (Bartholomew).

93. Atriplex expansa Wats.: Southern Kansas; common in alkali and salt marshes (Carleton in Cont. Nat. Herb., vol. I, p. 231).

94. Chenopodium fremonti Wats.: Rooks county (Bartholomew).

95. Chenopodium fremonti, var. incanum Wats.: Norton county (Smyth & Harshbarger).

96. Kochia americana Wats.: Southwestern Kansas, in salt marshes (Carleton in Cont. Nat. Herb., vol. I, p. 231).

97. Eriogonum lachnogynum Torr.: Morton county (Cont. Nat. Herb., vol. I, p. 214).

98. Phoradendron flavescens Nutt.: Labette county (Dr. W. S. Newlon).

99. Euphorbia cordifolia L.: Rooks county (Bartholomew).

100. Euphorbia cuphosperma Boiss.: Rooks county (Bartholomew).

101. Euphorbia fendleri Torr. and Gray: Meade and Comanche counties.

102. Euphorbia heterophylla L.: Shawnee, Morris and Cowley counties, in woods.

103. Euphorbia hirtula Eng.: Rooks county (Bartholomew).

104. Euphorbia peplidion Eng.: Meade county, on chalk hills.

105. Stillingia sylvatica L.: Cowley and Stafford counties, in salt marshes.

106. Ulmus alata Mx.: Cherokee and Labette counties (Doctor Newlon).

107. Smilax ecirrhata Wats.: Franklin county (Castle).

108. Erythronium mesochoreum E. B. Knerr: Leaves lance-linear, bright green beneath a faint bloom, never mottled with purplish blotches, averaging ½′ to ¾′ wide by 6′ to 8′ and sometimes 10′ long; perianth white, tinged a delicate lavender along the veins, and with a yellow blotch toward the base, half reflexed when in full bloom, 1′ to 2′ long; style slender, club-shaped, arising at a slight angle or almost straight from the ovary; stigmas three, recurved, distinct; ovary oblong, bluntly triangular, with sides convex; ovules oblong ovoid; capsules oblong or elongated obovate, ¾′ to 1¼′ long; sterile plants with but one leaf, appearing later than the fertile two-leafed forms, and few in comparison; corm more or less elongated, consisting of several, one within the other, the outermost enlarging for next year's plant (no underground runners producing corms at their extremities as in *E. albidum*). Open, grassy hilltops and north-facing slopes, as well as in like wooded localities, March and early April, Atchison county.—Smyth's Check List of the Plants of Kansas.

109. Tradescantia virginica L., var. villosa Wats. Barton and Russell counties (S.); Rooks county (Bartholomew).

110. Ruppia maritima L.: Stafford county, in salt marsh (Cont. Nat. Herb., vol. I, p. 217).

111. Cyperus hallii Britton: Sumner county (Cont. Nat. Herb., vol. I, p. 217).

112. Cyperus strigosus L., var. capitatus Bœckl. Kingman county (Cont. Nat. Herb., vol. I, p. 217).

113. Heteranthera limosa Vahl.: Rooks county (Bartholomew).

114. Scirpus atrovireus Muhl., var. pallidus Britt.: Cloud county (S.)

115. Scirpus hallii (Gray) Britt.; Rooks county (Bartholomew).

116. Andropogon hallii, var. flaveolus Hackel: Kingman and Kiowa counties (Carleton in Cont. Nat. Herb., vol. I, p. 222).

117. Andropogon saccharoides Swz., var. submuticus Vasey: Barber and Comanche counties.

118. Aristida dispersa Trin. & Rup.: Clark county (Cont. Nat. Herb., vol. I, p. 218).

119. Aristida humboldtiana Trin. & Rup.: Seward and Meade counties (Cont. Nat. Herb., vol. I, p. 218).

120. Aristida oligantha Mx., var. minor Vasey: Rooks county (Bartholomew).

121. Aristida purpurea Nutt., var. berlandieri Torr.: Rooks county (Bartholomew).

122. Aristida purpurea, var. fendleriana Coulter: Phillips county (Smyth & Harshbarger).

123. Aristida purpurea, var. hookeri Torr.: Rooks county (Bartholomew); Ford county (Carleton).

124. Beckmannia erucæformis Host.: Cheyenne and Sherman counties, in water holes, introduced from the West (Smyth).

125. Eragrostis pectinacea, var. spectalilis Gray: Sedgwick and Sumner counties (Smyth); Barber county (Cont. Nat. Herb., vol. I, p. 219).

126. Eriochloa punctata Hamil.: Clark county (Cont. Nat. Herb. vol. I, p. 218).

127. Muhlenbergia gracillima Torr.: Clark county (Cont. Nat. Herb., vol. I, p. 218).

128. Panicum nitidum Lam.: Rooks county (Bartholomew). This is distinct from P. sphærocarpon Ell., with which it has heretofore been confounded.

129. Panicum virgatum L., var. glaucum Vasey: Rooks county (Bartholomew).

130. Setaria perennis Hall: Culm ascending or erect, 3 to 7 dm. high; spike cylindrical, simple, green, 2 to 7 cm. long; bristles few, little longer than the spikelets. Propagates freely by slender perennial rootstocks, and seldom ripens seed where cattle freely graze. Frequent in damp alkaline and saline bottoms in central and southwestern Kansas. Resembles and may be a form of S. caudata R. & S.—Smyth's Check List of the Plants of Kansas.

131. Sporobolus pilosus Vasey: Perennial, from thick roots; whole plant pale green; culms cespitose, rigid, erect, about 1½ ft. high, leafy, particularly at the base, mostly simple; sheaths smooth, the uppermost sheathing the base of the panicle, the lower crowded and flattened; ligule inconspicuous; the throat, margin and both sides of the lower blades pilose, the upper ones involute and attenuated to a long point, shorter than the culm; panicle terminal, spike-like, 2 to 3 inches long, close, the lower part included in the sheath; spikelets 2½ lines long, smooth, the lower empty glume one-fourth shorter than the upper, which equals the fl. gl. and palet, all obtuse. Resembles S. asper, which has the leaves longer than the culm, both empty glumes shorter than the flower, and the leaves smooth or not pilose. Collected in Kansas by B. B. Smyth.—Botanical Gazette, vol. XVI, p. 26.

132. Sporobolus texanus Vasey: Perennial; culms 3 dm. high, rather rigid, and rarely branching below, the upper half occupied by the capillary-branched panicle; leaves linear lanceolate, rigid, 2.5 to 7.5 cm. long, acuminate, light green, scabrous above; the lower sheaths and ligule covered with loose white hairs; panicle half the length of the plant, sheathed at the base, becoming diffuse, the branches mostly single and few-flowered, the lower 5 to 8 cm. long; spikelets about 4 mm. long, on capillary pedicels; empty glumes unequal, the lower ones acute, less than half as long as the upper, the latter as long as the spikelet. Resembles S. asperifolius, but with simple, erect culms, and more rigid. Clark county (Cont. Nat. Herb., vol. I, p. 219, citing vol. III, p. 63).

MOSSES.

133. Coscinodon wrightii Sull.: Rocks, W. K.; frequent (S.)

134. Orthotrichum cupulatum Hoffm., var. minus Sull.: Rocks, Riley county (collected by Minnie Reed, Manhattan, and determined by Mrs. Elizabeth T. Britton, Columbia College, New York city).

135. Leptobryum pyriforme Schimp.: Shady ground, rotten wood, etc., E. K. (S.)

136. Webera nutans Hedw.: Wet ground, etc., E. K. (S.)

137. Timmia cucullata Mx.: On damp ground, E. K. (S.)

138. Meteorium nigrescens Mitt.: Shawnee and Riley counties (Miss Reed).

139. Leskea obscura Hedw.: Base of trees, low ground, Pottawatomie county (Miss Reed).

140. Cylindrothecium compressum B. & S.: Base of trees; common (S.)

141. Climacium americanum Brid.: Rotten log, in shady thicket, Shawnee county (collected by B. B. Smyth, and determined by Dr. G. N. Best, Rosemont, N. J.)

142. Hypnum (Thuidium) gracile B. & S.: Rotten log, in shade, Shawnee county (S.—Doctor Best).

143. Hypnum (Rhynchostegium) geophilum Austin: Shady clays, Wilson county (Miss Reed).

144. Hypnum (Amblystegium) radicale Beau.: Roots of trees, etc., Riley county (Miss Reed); Shawnee county (S.—Doctor Best).

ALGÆ.

145. Chara gymnopitys A. Br. var.: Stafford county (Cont. Nat. Herb., vol. I, p. 219).

146. Chara coronata A. Br.: Norton county (S.)

147. Nitella capitata Ag.: Cloud county (Carleton).

PARASITIC FUNGI.

(Not heretofore published from Kansas in Kansas lists.)

148. Chætomium pusillum Ellis & Everhart, *n. sp.* (Proc. Phila. Acad. Nat. Sci., 1890, p. 220): On an old churn in cellar, Manhattan (Kellerman).

149. Parodiella grammodes (Kze.): Psoralea rust. On Psoralea tenuiflora, Sherman county, and all through western Kansas (collected by B. B. Smyth, and determined by G. H. Hicks, Michigan Agricultural College, Lansing, Mich.)

150. Rosellinia kellermanni E. &. E., *n. sp.* (Proc. Phila. Acad. Nat. Sci., 1890, p. 228): On rotten wood of Negundo aceroides, Manhattan (K. & Sw.)

151. Teichospora kansensis E. & E., *n. sp.* (l. c., 1890, 243): On outer bark of cottonwood trees (Dr. J. W. Eckfeldt, West Philadelphia, Pa.)

152. Nectria athroa E. & E., *n. sp.* (ibid., 1890, 247): On decaying sycamore log, Manhattan (K. & Sw.)

153. Thyronectria chrysogonum E. & E., *n. sp.* (ibid., 1890, 248): On bark of white elm, Manhattan (K. & Sw.)

154. Puccinia malvastri Pk.: Mallow rust. On Malvastrum coccineum, Sherman county (S.—Hicks).

155. Uromyces astragali (Opis.): Sacc. Loco rust. On Astragalus mollissimus, Phillips and Norton counties; very severe on the plants sometimes (S.—Hicks).

These 132 species of flowering plants and 23 flowerless plants, added to the lists of 2,260 already published, make a total 2,415 species of plants in Kansas, including 1,790 flowering plants, 40 ferns and filicoid plants, 108 mosses, 3 algæ (2 Charæ and 1 Nitella), 7 fungi (mushrooms and puffballs), 1 liverwort (Marchantia polymorpha), and 8 parasitic fungi, published in these transactions at various times since 1876 by J. H. Carruth and the writer, and 458 species of parasitic fungi, published in volumes IX, X, XI and XII of these Transactions, by Professors Kellerman, Carleton, and Swingle.

The above number does not include any lichens, of which 35 species have been published by F. W. Cragin in Washburn Bulletin, any scale mosses, any liverworts, except M. polymorpha, as just stated, or 150 species of fungi (mushrooms, etc.), published by Professor Cragin in Washburn Bulletin. The inclusion of these lists makes in the aggregate 2,640 species, and the determination of material in hand will probably increase the number of Kansas plants to 2,750, as some of these classes are well represented in the State.

There are other species of flowering plants undiscovered all through the State, and much undiscovered material in the flowerless plants; and it now remains for some competent person to work up and verify the material on hand, and construct a new and more accurate list.

SOME CHARACTERISTICS OF THE GLACIATED AREA OF NORTHEASTERN KANSAS.

BY ROBERT HAY, F. G. S. A.

Northeastern Kansas, from the Missouri river to west of the Little Blue river, and as far south as the mouth of the Big Blue and the Wakarusa, had a share in the glacial submergence that affected all the northeastern and north-central part of the North American continent. The theory of this ice age is, that, from some change in the earth's axis, the precession of the equinoxes, or one or both of these, combined with diminished solar influence, due to the attainment of the maximum eccentricity of the earth's orbit, or other cosmical or terrestrial changes, producing increased length of winter in the northern hemishere, the arctic conditions now fully represented in Greenland were expanded southerly, a great sheet of ice covering the continent as far south as the 39th parallel and as far west in Dakota as the 100th meridian. The change from this glacial climate to the modern conditions of the temperate zone was effected by opposite cosmical or terrestrial conditions, and the ice sheet melting on its southern edge retreated northward with halting steps or rapid progress, according to the strength or feebleness of the operating forces.

There are certain deposits in the region which seem to have been formed under the ice, others that were formed of material that was on and in the ice and laid down in streaks and patches as the ice melted, and others, yet again, deposited in the cold waters — lakes or streams — that fronted the ice sheet both in its extension and retreat. Since the disappearance of the ice sheet, vegetation has formed the black soil over the whole region. In Iowa, Michigan, and elsewhere, the finding of black soil and semifossilized wood *below* subglacial deposits, and *above* other deposits as certainly formed in the ice period, has indicated to the observers that the whole time of the glacial period was divided into two, or that there was an interglacial time, in which the ice retreated and that vegetation flourished, and the ice again advanced to about its former southern limit. In most of the ice region of the Mississippi valley, the southern border of the newer ice is about coincident with that of the first advance of the ice sheet, and the phenomena of the older glacial period are only to be examined where drainage or well sinkers have cut below the bog and soils that indicate the middle period of milder climate. Whether the first retreat of the ice was only temporary or extended through a long period, is not yet positively determined among glacialists.

It seems certain, however, that the second advance of the ice did not overspread northeastern Kansas. Remembering that the ice retreated northward, it goes without saying that the glacial phenomena will be newer as we go in that direction from the southern border of the glaciated area, and if the retreat of the ice were very slow, the southern parts would have had a much longer time to be exposed to the weathering and denuding agencies of post-glacial time. Northeastern Kansas has an older surface far away than parts of Iowa, and topographical character is no longer of a glaciated type, as in the Dakotas.

One of the usual signs of glacial action is the presence of striæ, grooves in and planing of the surface of the bed rock, done by the ice and the hard pebbles and bowlders contained in it. This phenomenon is largely missing in Kansas.

Prof. L. C. Wooster, in a short article in a recent number of the *American Geologist*, records the finding of a striated area in Nemaha county. One or two local observers have known of these marks for many years, but it is only this summer that they have been definitely recognized. They have been seen by Professors Wooster, R. Hay, S. W. Williston, and G. H. Failyer, so that this Academy is pretty sure of their existence. The writer has, since then, examined an area in northern Pottawatomie county, as well situate for expecting striæ as the one in Nemaha: a north and south ridge, with bowlders of greenstone and quartzite scattered over both east and west flanks, and a hard limestone under a thin surface soil; the bottom of the soil undoubted glacial hardpan, four to eight inches thick, with pebbles in its paste. I uncovered some 20 square yards, but not a sign of striæ. Why? Because the limestone, which weathers in layers of an inch or two in thickness, had, under the action of the moisture, the carbonic acid, iron, etc., influencing its upper layer, become amalgamated with the hardpan, being soft, pasty, and ferruginous. In places this condition had penetrated to second and third layers of the stone. There were no striæ there because time has been an important factor. In samples of the striæ of Nemaha county, similar causes have begun to act in the direction of obliteration. Grooves have become channels for nature's operations, and their sides have begun to yield to the chemical agencies, and the character of the striæ is becoming obscured. It is, then, mainly due to the fact that the glacial operations in Kansas were made on the first part of the ice age that these characteristic striæ are few and poorly preserved in Kansas.

The phenomena we know as moraines should be recognized by their agglomerations of foreign bowlders. Most persons in northeast Kansas know of the existence of these bowlders — red quartzite, granite, hornblendic greenstone, etc.— but the order of their deposit is not plain. The writer, however, recognizes in three or four places where the deposit is clearly morainic: One west of the Little Blue, in Washington county, where the bowlders (not a very extensive deposit) rest on the Dakota sandstone; another 10 miles south of Topeka, on the Missouri Pacific railway, where the bowlders are strung out north and south for more than a mile; a third is west by south from Lawrence, where a long ridge from east to west marks where the glacier rested and dropped on its southern edge this heavy body of transported bowlders. It is manifestly the terminal moraine, but it is covered with loess and soil, and only on its southern side, in a few shallow ravines, is its true character seen. It was first shown to the writer by our late friend, Joseph Savage. Again, the ice seems to have rested its weather edge on the bluffs of the Kaw valley, west of Wamego. The bluffs rise precipitously, and on their precipitous front a single bowlder in more than a mile is all that tells of the ice; but once on the top, the soil is full of them, large and small, some just revealing a polished surface, some standing a foot or two high, many of them many tons in weight. Why only one bowlder on the south front? Because the erosion of the Kaw valley, which the glacier then dammed, has been going on so long, that much is carried away, and the later alluvia have covered the rest. The real southern limit of this moraine is seen in the bowlders on the bluffs of the south side of the Kaw valley, in Wabaunsee county.

Again, morainic material dammed the Kaw valley above Lawrence, and the remnant of it on the south side may be seen a few miles above the city, where the Santa Fé railway runs on a shelf of the moraine above the river.

Near Kansas City, the bluffs on both sides of the river are rocky and precipitous, with fillings of loess in preglacial ravines. But, between North Lawrence and North Topeka, most of the hills bounding the valley are rounded knolls of glacial material. This is true, also, near Rossville and St. Mary's. They are the weathered remains of kames or osars. In Washington county, there are series of these hills, where the decomposing granite falls to pieces with a touch.

It has fallen to the writer's lot, within the last three years, to make several visits to Iowa and the two Dakotas, spending, altogether, six or seven weeks in North Dakota alone. There the glacial phenomena are sharp, clear, and well defined. Lake basins are numerous; the drainage has not been completed. It is quite recently that the glacier left there, as compared with Kansas. The Turtle mountains are, probably, the spot where the retreating glacier lingered longest. Its osars and kames seem like the ridges of gravel described as on and about the southern edge of the great Muir glacier, of Alaska. The phenomena are all new. In northeast Kansas, the glacial phenomena are old, very old. Great morainic deposits, in Brown, Leavenworth and Douglas counties, are hidden by vegetation, which has covered the largest bowlders, and the deposits of gravels and clays have been assorted and arranged, and hills have been rounded to the angle of conservation.

The loess which belongs to the newer ice age has overlapped parts of glaciated Kansas; but there is an older loess that in places is very distinct, and the newer and the older loess, in front of the retreating, ice-carried icebergs, great or small, which accounts for a few glacial, subangular bowlders that have been found many miles beyond the limits recognized above as those of the ice sheet.

THE VARIABLE CHEMICAL COMPOSITION OF PLANTS AT DIFFERENT SEASONS—ILLUSTRATED BY TARAXACUM DENS-LEONIS.

BY PROF. L. E. SAYRE, UNIVERSITY OF KANSAS.

It is perhaps a well-known fact that the soluble principles elaborated by plants at different times during their growth differ very greatly, not only in quantity but also markedly in quality. For example, the common persimmon contains during the summer and until about frost a large percentage of a peculiar kind of tannin, which becomes replaced about the time of frost by glucose, pectin, yellow coloring matter, etc. Early in the spring, dandelion root contains uncrystallizable sugar, which diminishes during the summer. In autumn, it abounds in that starchy principle common to many of the roots of the natural order Compositæ, known by the name of "inulin." Pectin is also present to a large extent. There is also a bitter principle found in taraxacum root, called taraxacin, which makes it so valuable as a medical agent. Finally, it contains a very small percentage of a peculiar acrid principle soluble in alcoholic solutions.

Some years ago the attention of pharmacologists was directed to the subject: "The proper time for collection of dandelion root." Reviewing the literature, I find many communications to the journals from the pens of very able men; but these authorities differ as to the proper season for its collection and preparation for medicinal use, and, so far as I am able to learn, it is now a somewhat unsettled question. Very different seasons of the year are now recommended as the proper time for gathering. One authority recommends the beginning of spring, even before blooming; another, July, August, and September; another, that it should be collected between September and February. It stands to reason that that season of the year in which the bitter principle, taraxacin, is most abundant is the best time for collecting and drying. It has therefore occurred to me that I might bring forward this subject anew, and at different seasons of the year make such analyses of the root as will show the proportion and total amount of the various principles contained in the plant, making special note of the most important principle, taraxacin.

As I have just begun a series of analyses of the same roots collected in May and September, neither of these being fully completed, I shall be able to report only a few results in connection with the subject. I may add, also, that as the exact method of analysis has not been fully decided upon, I am obliged to say that the figures I herewith give may in future require some alteration.

The following table shows results of a preliminary analysis:

EXAMINATION OF TARAXACUM ROOT COLLECTED IN —

	May.	*September.*
Moisture in fresh root, dried at 45° C............	81.24 per cent.	73.00 per cent.
Loss in drying, at 100° C........................	13.45 "	11.79 "
Juice extracted by pressure......................	57.00 "	very small "
Percentage of solid in juice.....................	1.472 "	.....
Reducible sugar in juice.........................	.036 "	.02052 "

At a future time I hope to be able to verify these figures, and at the same time make a fuller report of all the principal constituents of the root at various seasons of the year.

THE NIOBRARA CRETACEOUS OF WESTERN KANSAS.

BY S. W. WILLISTON, STATE UNIVERSITY, LAWRENCE.

Even an approximately correct map of the outcrops of the Niobrara cretaceous in Kansas cannot be given until they have been systematically surveyed. The overlying tertiary is everywhere unconformable, and is found at varying levels, even within short distances. It is very evident that the main valleys of the region had been eroded before the deposition of the tertiary rocks, and, although the sandstones have been since almost wholly eroded in the valleys, yet they remain in isolated patches over a large part of the Niobrara region.

The most northern exposures of the rocks are said to be on the Sappa, but I have seen them only as far north as the Prairie Dog, where they occur at various places in the immediate river valley from Norton to the State line. On the North Fork of the Solomon the Niobrara reaches nearly to Lenora, though the western outcrops are insignificant. On the South Fork it appears as far west as the extreme western line of Graham county. On the Saline it reaches only a little way into Trego county. By far the greatest amount of exposure is found in the valley of the Smoky Hill, where denuded areas are found quite to the western line of the State. South of the Smoky Hill the exposures are very few.

At another time I shall give more fully the history of the explorations of these regions; at present a brief sketch will suffice. Almost the earliest collections of fossils from this region were made by army surgeons stationed at Fort Hays or Fort Wallace, especially Doctors Janeway and Sternberg.

The next explorer to make any scientific examination of the beds was, I think, Professor Mudge; but the first collections of moment were made by Professor Marsh, with a party of Yale students, who spent several weeks in the vicinity of Wallace, under an escort of United States soldiers, in 1870.

In 1871, Professor Cope made some valuable collections in the same region, an account of which is given in his Cretaceous Vertebrata. Again, in 1872, Professor Marsh with a party spent several weeks, under hardships similar to those of his first expedition, on the upper Smoky Hill. In this and the following season, Professor Mudge made collections in the northern part of the State, among which was the first specimen of a bird showing teeth, which specimen has never been equaled since. All these collections, however, were trivial in amount and value to the extensive collections made during the following four or five years, by parties of which Professor Mudge, H. A. Brous, E. W. Guild, George Cooper, Charles Sternberg and the writer were members.

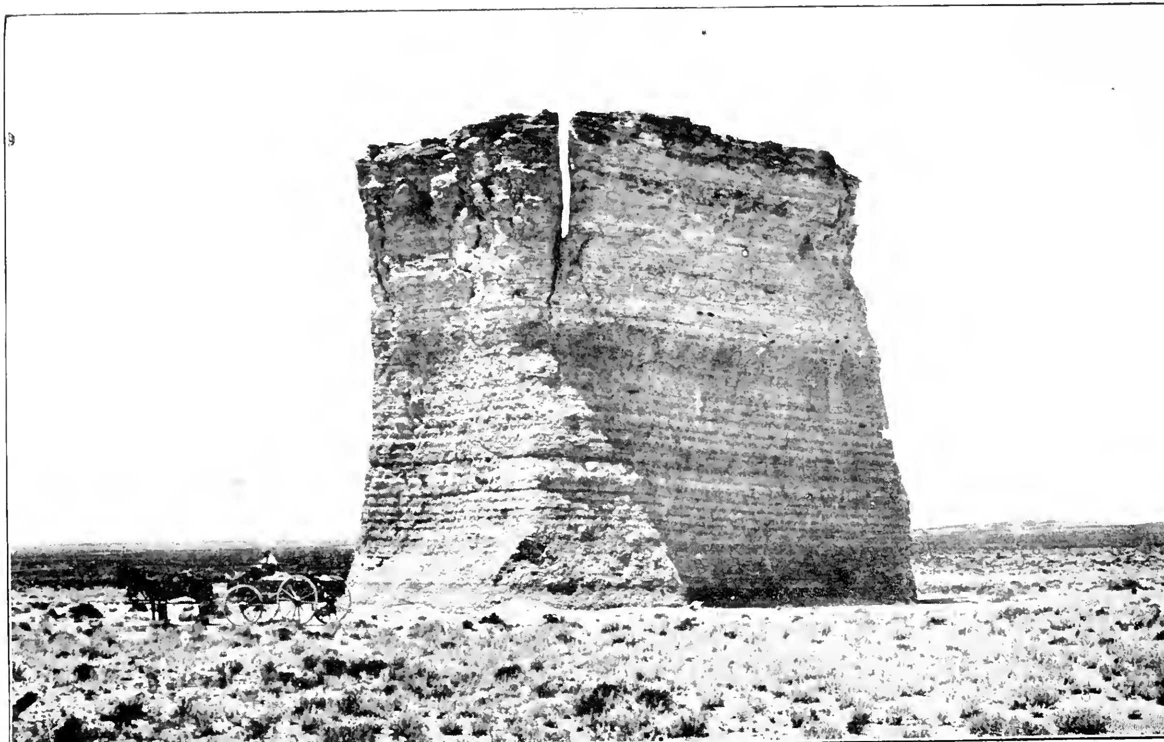
In more recent years, aside from some isolated specimens that have found their way into collections, many interesting specimens have been collected by Professor Snow, the late Judge E. P. West, Dr. George Baur, Charles Sternberg, E. C. Case, and myself. To none of these collectors, however, is so much credit due as to the late Professor Mudge, my teacher and friend. While another, well-known author has recounted the hardships and dangers to which he was subject under the guardianship of United States soldiers, Professor Mudge explored the regions wholly unprotected, where danger from marauding Indians was often imminent. To Mudge is also due the first, and, until now, almost our only published knowledge of the extent and physical characters of the regions explored. Much of the information gathered by him is, from the necessities of the case, incomplete and fragmentary, and in some cases erroneous. There were scarcely any railroads then in the region, and explorations required long and painful travels by wagon and on foot, oftentimes scores of miles from the nearest human settlement. During nearly all the time that Professor Mudge was in these regions, I was a member of his parties, and have since spent some 10 months in similar explorations. I may, therefore, be permitted to offer the following in continuation or correction of what he has published:

The thickness of the Niobrara rocks has been hitherto underestimated. At Elkader, in the valley of the Smoky Hill, in Logan county, repeated observations with a good barometer gave 290 feet between the bottom of the valley and the highest Niobrara rocks underlying the tertiary sandstone. Wells in the vicinity had penetrated at least 40 feet further without passing through the blue chalk, making a total of 330 feet as the observed thickness at this place. From stratigraphical reasons, which will be understood later, it seems certain that at least another 100 feet may be added to this, giving as a minimum 430 feet as the total thickness at this place.

There are many difficulties in the way of an absolutely correct measurement of the outcrops. The rocks nowhere present clear lines of stratification over extended areas. A slight difference in the coloration or the effects of weathering is all that can be relied upon. Further, there are no extended areas of denudation where a true knowledge of the dip can be ascertained, and, in addition, there are numerous local disturbances which interfere with observations on a large scale.

I am satisfied that the dip toward the north or northeast is much greater than has been suspected, save, perhaps, by St. John. The rocks thin out with remarkable rapidity south of the Smoky Hill, and are, I believe, wholly unrepresented south of the Arkansas river. While the rocks in southwestern Trego county are not less than 200 feet thick, in Rush county, 30 miles to the southeast, the tertiary of the tablelands lies immediately upon the Benton. The very characteristic, heavy, stratified chalk, or soft, white limestone, at the base of this formation, about 80 feet in thickness, extends across the State, from near Mankato, in Jewell county, on the north, to north of Coolidge, in Hamilton or Greeley county, on the west. Its character and thickness, wherever seen, are so unmistakable that it is at once recognized. In the vicinity of Hays City, in Ellis county, its elevation is less than 1,900 feet; at the western line of the State, more than 3,400 feet—an increase in 175 miles of over 1,500 feet.

About 50 miles east of north of the westernmost outcrops the uppermost rocks of the cretaceous appear at an elevation of 3,100 feet. But these upper cretaceous rocks at McAllaster are at least 400 feet above the lowest, making a dip, if I am not mistaken, of 600 or 700 feet in the 50 miles. Before this remarkable dip had become evident to me by the discovery of the basal strata in Hamilton county, I had been very much at a loss to account for the marked northern inclination of the stratified, or Fort Hays beds, as I will call them, in Ness and Trego counties. This marked northeastward inclination of the strata has already been spoken of by



SOUTHERNMOST OF THE MONUMENT ROCKS,
NIOBRARA CRETACEOUS, SMOKY HILL VALLEY, GOVE COUNTY, KANSAS.
From a photograph by S. W. Williston.

St. John, in his report for 1885, where he shows that the exposure of the characteristic leaf-bearing Dakota sandstones in the extreme southwest is at least 1,100 feet higher than at Larned, in Pawnee county, or 1,700 feet higher than in Saline county; observations quite in accord with my own.

In Lane county, south of Dighton, on the head waters of the Walnut, I determined the Niobrara cretaceous. In all probability there is a small outcrop of the same on the head waters of Pawnee Fork, and possibly also north of Coolidge. Professor Hay tells me that there is a small outcrop on the White Woman, in Greeley county. I believe that these are the southernmost outcrops of the formation in the State. The Benton probably occurs furthest south in the longitude of Meade county, where St. John and Hay have determined rocks of a more recent age than the Dakota.

There is a very interesting problem in this connection. In Professor St. John's report, he says (page 145) the Niobrara rocks of the southwest "consist of only a few feet thickness, of light, creamy, buff chalky limestones, in rather even layers, from a few inches to a foot thick, and in places charged with Inoceramus problematicus, another large, thin-shelled, undetermined species, and remains of bony fishes, such as characterize the Niobrara formation in the region to the north and northeast. . . . Similar exposures occur on north-side tributaries of Crooked creek, in the southwest part of Ford county. The limestone at the latter localities has also been quarried to a limited extent, and it affords the same species of fossils. These occurrences are identical with those on Sawlog creek, north of Fort Dodge, and in the valley of Pawnee Fork, in Hodgeman county. . . . The heavy limestone deposit that forms the upper horizon of the Benton, of the Smoky Hill, is apparently wanting in this southwest region."

Six miles south of Rush Centre, I found a similar deposit, less than 50 feet in thickness, lying upon undoubted Benton rocks, and covered by the tertiary of the summit of the divide. At the time of my visit, I had no doubts of its Niobrara character, and later Niobrara as well. It showed the same chalky shales, numerous specimens of small shells, and fragments of weathered fish bones. I was exceedingly surprised a few days later to discover the massive, chalky limestone less than 20 miles north, on Timber creek. Further, this limestone undoubtedly occurs on the Walnut; Mudge says that it occurs on the Pawnee, and I found it north of Coolidge. In other words, it runs uninterruptedly through the State, and, without doubt, St. John's outcrop, as well as that of Rush county, are earlier. We have much to learn of the Benton in Kansas, and, I believe, many interesting results to obtain.

The divisional line between the Benton and Niobrara I take at the top of the stratified beds already mentioned, following Mudge. But I am not at all certain that it should not be placed below this, or even below the subjacent dark-blue shale. Its chief distinction is its firmer texture, its comparative barrenness in fossils, and its well-marked lines of stratification. Its invertebrates are much more like those of the Niobrara than those of the more yellow limestone below. These fossils, however, are much more broken up and much less numerous. Immediately overlying this, and conformable with it, is found the true chalk of the Niobrara. In microscopic structure, the chalk, whether from the highest or the lowest of the outcrops, seems tolerably uniform, and closely resembles the English chalk. The great mass of the material is made up of coccoliths, but with a considerable quantity of both rhabdoliths and foraminifera. In its gross characters, however, there is not a little difference between the upper and lower beds. In the lower portions, the chalk, where exposed, is white or gray, never deeply yellow, and the shales are of a lighter blue. In the upper portion, the chalk is more yellow, and often shows decidedly buff or reddish tints. It is also here smoother and softer to the touch. There is, also, a very marked difference between the upper and the lower beds, in the relative amount and in the kinds of fossil remains. In the very lowest, the exposures are exceedingly barren in vertebrate fossils. A day's search will not reveal a half dozen specimens of any kind. In one day last year, the three members of my party found over 30 saurians, five or six pterodactyls, several turtles, and fishes innumerable, in the upper beds. On the other hand, the invertebrates are here especially numerous, strewing the surface in heaps; large and perfect Haploscaphas, Rudistes, etc., can be obtained literally by the wagon load, while, for the most of them, one would search the upper beds in vain. I have never known any reptilian remains to be found within 100 feet of the base, though, in all probability, some species do occur here. As we go upward, the vertebrates become more abundant, and the invertebrates, save the ostrea and the large, thin-shelled, four-foot inoceramid, and perhaps some others, become markedly less numerous. Among the vertebrates, two of the three genera of the mosasaurs occur throughout, but the third, Clidastes, I have never known to be found save in the upper part. The plesiosaurs are rare everywhere, but relatively more abundant in the lower strata. Of the pterodactyls, the larger species are relatively more abundant below, though absolutely more numerous above. Finally, the turtles are exceedingly rare in the lower parts, but are very commonly met with in the uppermost strata. With two possible exceptions, the birds have never been found below the yellow chalk. This all seems to show that the water gradually became more shallow, and the shore lines less remote, as the formation grew younger.

The horizon of the yellow chalk can be readily traced, from near Monument Rocks on the south, northeastward to the Saline, north of Wa Keeney, and thence to the South Fork of the Solomon, near Hill City. It occurs on the North Fork of the Solomon, east of Lenora, but how much further east I cannot say. Some small outcrops, apparently of the same, I have observed on the Prairie Dog, near Norton.

It will be seen from the foregoing that I admit of no stratigraphical distinction between chalk and blue shale. The difference between these is wholly chemical, and has nothing to do with the geological position. I may add that the rare crinoid, Uintacrinus, which was originally described from Kansas specimens, seems to be confined to one horizon, near the middle of the beds. A large and magnificent slab or plate of these interesting fossils, covering fully 20 square feet, was obtained by our party the past year from the Smoky Hill, near Elkader, and now is one of the treasures of the State University museum.

Some years ago, Professor Mudge discovered, near the old town of Sheridan, a large mass of baculite. On referring specimens of them to the veteran paleontologist, the late Professor Meek, the species was determined as Baculites anceps, with the following remarks, as published by Professor Mudge: "One fact in regard to your specimens, however, is very curious to me. All the other forms like this that I have ever seen from any part of the far West come from Nos. 4 or 5, while all of the species yet known from these upper rocks are distinct from anything found in Nos. 2 or 3. Can it be possible that you might have found this in anoutlier of Nos. 4 or 5? It has the shell substance well preserved, like the fossils of these upper beds, while those in the lower beds are usually casts." Mudge, however, thought that the deposit was clearly Niobrara.

I believe that Meek was right, and that the beds here represented are either of the Fort Pierre group, or transition beds to that group. My reasons are as follows: Not another specimen, so far as I know, of this baculite or of any other has ever been found below this horizon. Furthermore, in a visit to the locality the past year, a careful search did not reveal any other invertebrates known from the chalk below it, but did disclose one or two other mollusks that I have never seen elsewhere in all the years I have spent in this formation. I have not yet had an opportunity to de-

OUTCROP OF NIOBRARA CRETACEOUS CHALK,
PLUM CREEK, GOVE COUNTY, KANSAS.
From a photograph by S. W. Williston.

termine the species, but I confidently expect to find them identical with species from the Fort Pierre group, if not new. Furthermore, of the vertebrates that I know from these beds, all seem different from those of the beds below. One of them I have recently described as Clidastes westii, the most aberrant species in the genus.

Lithologically, the outcrops, which are not extensive, are all of a deep blue color, with numerous and large septaria, in which are found the large and beautiful crystals of baryte. The outcrop occurs at the extreme top of the Niobrara, on the North Fork of the Smoky Hill and in the vicinity of Fort Wallace. The first true Niobrara yellow chalk was observed near the mouth of the North Fork, at an elevation nearly 100 feet below the McAllaster outcrops.

In this connection, it will be of interest to observe that Hay has found "an outcrop in Norton county of two well-marked strata above the yellow chalk," consisting of green sand and green clay shale. (Sixth Bien. Rep. St. Bd. of Agric., p. 103.) Whether or not they belong to an upper cretaceous horizon remains to be shown.

NOTES ON THE ELEMENTARY COMPARATIVE EXTERNAL ANATOMY OF INSECTS.

[For use in entomological laboratory of the University of Kansas.]

BY VERNON L. KELLOGG, UNIVERSITY OF KANSAS, LAWRENCE.

A laboratory course in entomology of 20 weeks, 10 hours' work a week, is offered in the University as a junior or senior optional. Students electing this course have had a 20 weeks' course, 10 weeks of lectures and 10 weeks of laboratory work for 10 hours a week, in general zoölogy. The object of the course in entomology is to train the student in accurate work in anatomical detail, and to give him a knowledge of insect anatomy upon which further work in the comparative anatomy of insects or the determination of species may be based.

A very excellent laboratory guide for this course is that begun by Prof. J. H. Comstock, of Cornell University, and by him called (A Fragment of a) Guide to Practical Work in Elementary Entomology. This guide covers, in careful detail, the external anatomy of the common red-legged locust (*Caloptenus femur-rubrum* De Geer). As a continuation of similar work in external anatomy, I have prepared some laboratory notes (printed as a pamphlet of 12 octavo pages) entitled as at the head of this paper, and comprising anatomical notes on the following subjects: The head and thorax of the milkweed butterfly, *Danais archippus* Fabr.; the mouth parts of the honeybee, *Apis mellifica* Linn.; and the pleural sclerites of the rummaging ground beetle, *Calosoma scrutator* Fabr. The nomenclature of aspects and directions used is that adopted by Professor Comstock (after Professors Wilder and Gage, Cornell) in his "Guide."

In the "Notes" issue is taken with Burgess's statement (see his Contributions to the Anatomy of the Milkweed Butterfly, *Danais archippus* Fabr.) that the clypens of *archippus* "passes directly into the epicranium without any suture or line of demarcation." A suture extending between the antennary fossæ separating clypens from epicranium is plainly to be made out. The patagiæ of the thorax of *archippus* are found to be outgrowths of the meso-thoracic paraptera. The meta-thoracic paraptera are also described. The peculiar shape of the epicranium, accommodating itself to the overlarge compound eyes, is described, and the occiput, gula and labium are described, all of which are points untreated by Burgess.

The "Notes" are not illustrated, the student, as with the "Guide," making the required drawings solely from the specimen in hand. The insects chosen are common forms, easily obtainable anywhere in the United States.

INSECT NOTES.

BY VERNON L. KELLOGG, UNIVERSITY OF KANSAS, LAWRENCE.

It is hoped to present annually a few notes on Kansas insects, paying special attention to those of economic importance. As no such notes were presented last year, certain observations made in 1891 are included in the notes of this year.

WHEAT-STRAW WORM (*Isosoma tritici* Riley).

A considerable amount of injury to Kansas wheat accredited to the Hessian fly is really done by the wheat-straw worm. In 1891, this insect was reported from about one-fourth of the counties of the State, being especially prevalent in central and western Kansas. Adults issue in March and April from last year's wheat straws, either in stubble or volunteer or stack, and oviposit on the young winter wheat. The adults of this brood emerge in the latter part of May and early part of June. The eggs are laid in the now maturing wheat, and the larvæ pupate in the stubble or in the stack before winter. The larvæ usually lie just above the second node below the head. In a bunch of straws from Russell county, over 75 per cent. were infested. In these straws, 40 per cent. of the pupæ were found above the first node below the head, 50 per cent. above the second node, and 10 per cent. elsewhere. They lie in small, gnawed-out cells, and the heads are almost invariably directed up, *i. e.*, toward the head end of the straw. *Eupelmus allyni* proves an effective natural check to this pest, the parasitism being noticed in all examinations made. As but about 5 per cent. of the straw worm flies have wings, the pest does not spread rapidly, and local efforts in fighting it, by burning old stacks and stubble containing pupæ, in the winter or early spring, are very effective. A bulletin was issued by the department of entomology of the University, in February, this year, calling attention to the presence of this pest in the State, and recommending the burning of old straw stacks and stubble.

A NEW BIBIO (*Bibio tristis* n. s.)

A Bibionid fly appeared in large numbers in many Kansas wheat fields during the last week of April, this year. It was reported from seven western counties. viz., Geary, Saline, Lincoln, Ellsworth, Pratt, Rice, and Smith. Farmers in these counties were alarmed by the presence of swarms of these flies, though in no case was any special damage apparent in infested fields. The larvæ of the flies were found in large numbers in the soil of a Pratt county field on February 10. Some larvæ were found also in hotbeds in which various flowers were growing. Adults were first reported on April 17, and from then constantly until the end of the first week in May. A correspondent in Lincoln county noted that pupation began about April 20, the adult flies appearing by April 27.

The flies were very abundant wherever present, but no injury to the wheat could be positively traced to them. The fields most badly infested gave no signs of unusual injury. The larvæ of the Bibionid family are known to feed on the roots of various plants. The flies disappeared suddenly and simultaneously. With the *Bibios*, several Anthomyid species appeared in lesser numbers. *Sciara* sp. (?) was sent in from several fields with the *Bibios*.

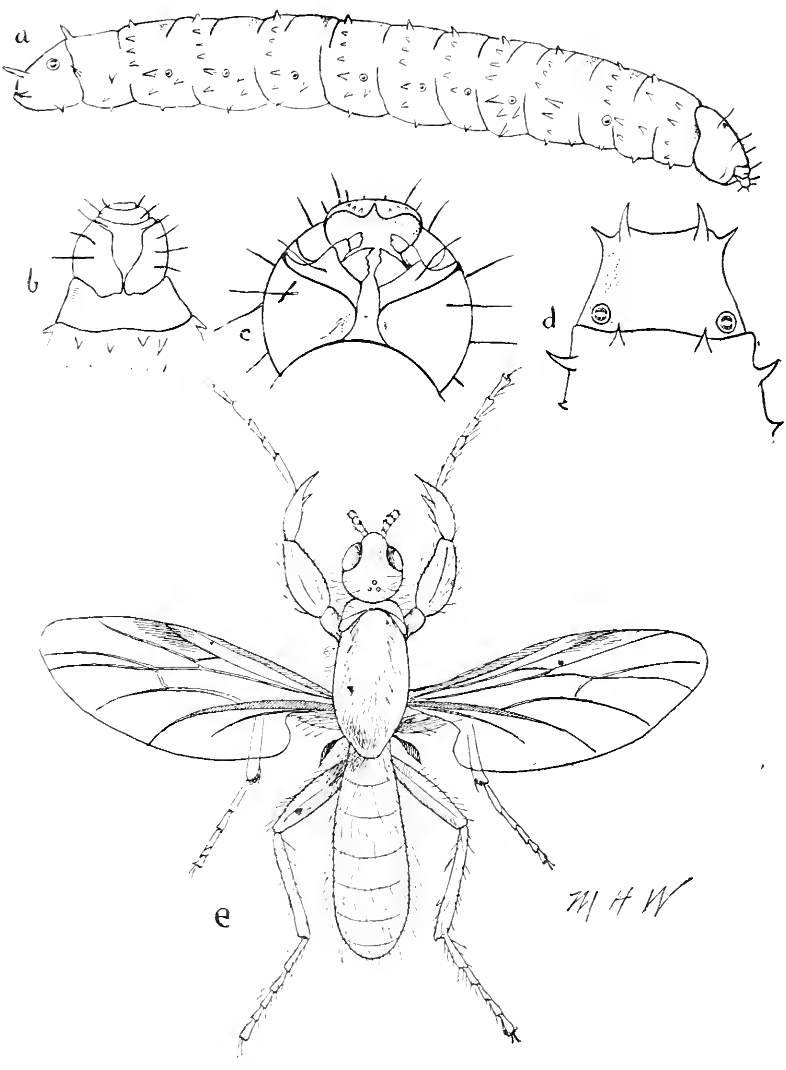
On examination, Dr. S. W. Williston finds this *Bibio* to be undescribed, and has kindly furnished the following description, proposing to name the species *tristis*.

BIBIO TRISTIS (n. s.)

Female.— Black, shining, legs red; spines of front tibiæ very unequal in size; wings dilutely subfuscous, the costal margin brownish; pile black. Length 00 mm.

Male.— Legs darker, mostly blackish.

Female.— Black, shining, the venter and the coxæ, save the front pair in part, of the same color. Pile black, somewhat whitish on the abdomen. Legs red or yel-



BIBIO TRISTIS.—*a*, larva: *b*, venter, posterior segment of larva; *c*, ventral aspect of head of larva, showing mouth parts; *d*, dorsum, posterior segment of larva; *e*, adult.

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lowish-red, the knees, tip of tibiæ and tip of tarsi more or less blackish. Spines of the front tibiæ very unequal in size, those of the hind tibiæ small. Wings dilutely subfuscous, lighter posteriorly, the costal margin narrowly brownish, the anterior veins brown. Stigma brown.

Male.—Pile longer. Legs deep red, in large part blackish.

Kansas. The species is nearest allied to *B. obscurus* Loew and *B. xanthopus* Wied., but may be at once distinguished by the black pile.

The larvæ of the *Bibionidæ* differ from the most of dipterous larvæ in having well-developed mandibles and palpi, in place of the more common simple hooks. The larva of this species is about three-fourths of an inch long; general color dirty-whitish; surface of body finely punctuate; head dark brown; each segment with a single transverse line of six pointed projections on dorsum, and two transverse rows of six projections, beginning on pleura near the spiracle and extending across the venter. These projecting points assist in locomotion. There are no feet. Spiracles are present on the third to eleventh segments, counting the head as first segment. There are no spiracles on the twelfth segment. On the dorsum of the thirteenth (last) segment on either side there is a conspicuous dark eye-spot (spiracles?). In the plate herewith these anatomical details are shown.

Western Corn Root Worm (*Diabrotica longicornis* Say).

The attacks of this pest in Kansas cornfields are too often not recognized, the results of the insect's work, *i.e.*, the stunting and falling over of cornstalks, being accredited to drowning or to drouth, or to lack of nourishment in the soil. The adult insect is a small, bluish-green beetle, which feeds largely on corn pollen. The "worm," or larva, does the real damage by burrowing into the tender growing roots of the corn, and, by destroying the roots, starving the corn plants. In badly-infested fields a strong wind will topple over many of these rootless plants.

This pest has been reported from many localities in Kansas during 1891 and 1892. Mr. S. J. Hunter, a student of entomology at the University, has compiled some interesting notes regarding the occurrence of this insect this summer in the neighborhood of his home, Greeley, Kas. A field of 30 acres, which has been in corn for six years consecutively, is damaged in spots all over. About 10 acres will not make more than one-third of a crop. Another field of 14 acres, which has been in corn for five consecutive years, is damaged one-third. Twenty acres of another 30-acre field show the presence of the insect, about 5 per cent. of the stalks being affected. A half-dozen or more other fields in this neighborhood are infested, all of which have been in corn for several consecutive years.

The remedy for this corn pest is easy and sure. As the insect larvæ, so far as known, can live on nothing but corn roots, a simple rotation of crops will starve them out in any given field.

Ham Fly (*Piophila casei* Linn.)

In August, 1891, complaint was made by one of the large packing houses of Kansas City, Mo., that a "skipper" was doing much damage to smoked meats. Specimens of larvæ and adults, soon after received from the packing company, showed the pest to be the well-known cheese-skipper fly; its occurrence in packing houses having been several times before recorded. The amount of injury reported by the Kansas City packing house was surprisingly large, though only smoked meats were attacked. Shipments of bacons and hams were often returned by consignees because of the "skippery" condition of the meats. As much as $1,500 worth of spoiled meats were returned within one week.

In February, 1892, I received a large number of larvæ, and kept them in breeding jars. The breeding-cage notes show that the egg state is about four days, the larvæ state about two weeks, and the pupal state one week. The adult flies lived in the breeding jars from six days to two weeks after issuance from the pupariæ. Larvæ kept with ham and bacon did not take at all kindly to cheese, to which they were removed, although the fly is undoubtedly identical with the cheese-skipper fly.

The hams in the packing houses are smoked in a long shaft; adjoining the shaft are large rooms, into which the smoked hams are removed, and there inclosed in the cloth sacks. In these smoky rooms, and in the smoke-filled shaft itself, the adult flies swarm and lay their eggs on the hams. The sacks are put on the egg-infested hams, and the meat shipped. In the meanwhile the larvæ hatch, and the consumer removes the sack only to find a "skippery" ham. The problem is to prevent oviposition on the hams in the smoke shaft and in the bagging rooms. Measures recommended by Doctor Williston are now being tried, with what degree of success cannot yet be told.

THE FERMENTING FRUIT FLIES (*Drosophila* species).

Among some grapes of a small black variety, received from Mr. G. C. Brackett, secretary State Horticultural Society, several had broken skins, and the exposed juice was fermenting. In these fermenting grapes were to be found small dipterous larvæ, footless, and without other mouth parts than the hooks. They were about three-sixteenths of an inch in length when full-grown. Some of the infested grapes were isolated on October 1, and on the morning of the 4th the adult flies were obtained. They proved to be *Drosophila ampelophila* Loew, called by Doctor Williston the fermenting fruit fly, by Lintner the pickled-fruit fly, and by Comstock the vine-loving pomace fly. About 25 species of North American *Drosophilas* have been described, mostly by the late Doctor Loew and Mr. Walker of the British museum. They are all "fermenting" fruit flies, being attracted by any decomposing fruits. Doctor Williston has seen them in clouds about heaps of cider refuse. Doctor Lintner notes the occurrence of the species *ampelophila* in decaying peaches, and probably in sweet jam and sour pickles.

The flies are small, but brightly colored. The specimens bred from the Brackett grapes, species *ampelophila*, have bright red eyes, generally pale yellow bodies, with the last abdominal segment of the female and the last two of the male smoky black above. The wings are clear, being entirely unspotted. The flies are about one-tenth of an inch long.

The flies lay their eggs on or in the fermenting fruit, and the larvæ or maggots hatch in three or four days. The larvæ feed on the fermenting fruit about four days, and then change to the pupal state, which lasts about four days longer. The adult flies thus issue in about 12 days after the eggs are laid, and in their turn begin laying eggs in a couple of days after issuance. This fertility explains the large numbers of the flies.

The fermenting fruit flies should not be mistaken for the true apple-worm flies (*Trypeta pomonella* Walsh), the larvæ of which attack sound fruit, causing it to decay. The fermenting fruit flies attack only already unsound fruit. The adult fly of the apple worm is white and black, and its wings are distinctly banded. The apple-worm fly is also larger than the fermenting fruit fly, being about one-fourth of an inch in length.

Professor Comstock recommends inclosing the grape clusters in paper bags when the fermenting fruit flies are found in vineyards, as in Mr. Brackett's case. "A few pin holes should be made in the bottom of the bag, to allow the water to run out, which otherwise, in case of a storm, would collect and either rot the grapes or burst the bag."

MAXIMUM BENDING MOMENTS FOR MOVING LOADS IN A DRAW BEAM.

BY E. C. MURPHY.

This paper is part of an investigation which the writer has been making of "Maximum bending moments in structures carrying moving loads." Other papers by the writer on this general subject may be found in vol. 6, *Mathematical Messenger*, and vol. 1, *Kansas University Quarterly*.

The bending moment at any assumed point or section of a structure varies as the load passes over the structure. For some position of the load the moment at this point is greater than that for any other portion of the load, but the bending moment at some other point of the structure may be greater than at the assumed point; hence, to find the greatest bending moment which can ever be produced in a given structure by a given load, we must find the position of the load when it produces this maximum moment,* and the point or section of the structure where the maximum moment occurs.

Two kinds of moving loads are considered—a concentrated load and a uniformly distributed load.

CASE I—A CONCENTRATED MOVING LOAD.

Fig. 1 shows a draw beam sustaining its own weight and a concentrated moving load, P; the end spans are of equal length.

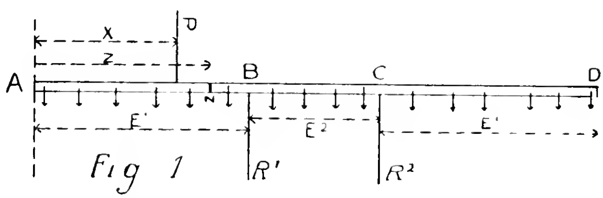


Fig 1

Let P = the concentrated load.

$l = 2l_1 + l_2$.

q = the weight of the beam per linear foot.

$w = ql$ = the weight of the beam.

R_1 and R_2 = the abutment reactions.

x = the distance from left end of beam to load, P.

z = the distance from left end of beam to section considered.

M'_1, M'_2, M'_3 = the moment in the 1st, 2d and 3d spans respectively, when P is in the 1st span.

M''_1, M''_2, M''_3 = the moment in the 1st, 2d and 3d spans respectively, when P is in the 2d span.

M'''_1, M'''_2, M'''_3 = the moment in the 1st, 2d and 3d spans respectively, when P is in the 3d span.

(M)max. = the maximum moment.

Considering the whole beam as a free body, and taking moments about A, we have—

$$R_1 l_1 + R_2(l_2 + l_1) - Px - \frac{wl}{2} = o. \quad (1)$$

From Σ (vertical forces) = o we have—

$$R_1 + R_2 - w - P = o. \quad (2)$$

* Hereafter in this paper the term moment is used in place of bending moment.

From (1) and (2) we find—

$$R_1 = \frac{w}{2} + P\frac{(l_1 + l_2 - x)}{l_2} \text{ and } R_2 = \frac{w}{2} - P\frac{(l_1 - x)}{l_2}.$$

Making a section at any distance z from A, z being less than l and greater than x, and considering the part on the left as a free body, we have—

$$M_1' = q\frac{z^2}{2} + P(z - x) \quad \text{(3)}$$

Differentiating M_1' with respect to z, and putting the first derivative equal to zero to find the position of the maximum moment, we have—

$$\frac{dM_1'}{dz} = qz + P = o \quad \text{(4)}$$

Solving (4) we have $z = -\frac{P}{q}$.

Since z is measured from the left end of the beam, negative values of it do not satisfy the conditions of this problem, and this value must be rejected. From (3) we see that, since the terms containing z are all positive, and the term containing x is negative, M_1' will be greatest when x is least and z has its greatest value, which are, for this first span, $x = o$ and $z = l_1$. Substituting these values in (3), we have—

$$(M_1')\text{max.} = q\frac{l_1^2}{2} + Pl_1 \quad \text{(5)}$$

For any section of the beam between B and C, *i.e.*, $z > l_1$ and $< l_1 + l_2$, we have—

$$M_2' = q\frac{z^2}{2} + P(z - x) - R_1(z - l_1) \quad \text{(6)}$$

$$\frac{dM_2'}{dz} = qz + P - R_1 = qz + P - q\frac{l}{2} - P\frac{(l_1 + l_2 - x)}{l_2} = o \quad \text{(7)}$$

From (7) we find $z = \frac{l}{2} + P\frac{(l_1 - x)}{l_2}$ ..... (8)

Examining (6) and the value of R_1, we find that R_1 is least, and consequently M_2' is greatest, when x is least, or zero. Substituting this value of x and the corresponding value of z found from (8) we have—

$$(M_2')\text{max.} = q\frac{l}{4}\left(\frac{l}{2} - l_2\right) + \frac{Pl_1}{2} \quad \text{(9)}$$

$$M_3' = q\frac{z^2}{2} + P(z - x) - R_1(z - l_1) - R_2(z - l_1 - l_2)$$

$$= q\frac{z^2}{2} + Pz - (w + P)(z - l_1) + \frac{wl_2}{2} - Pl_1 \quad \text{(10)}$$

Equation (10) being independent of x, the moment in the 3d span is not influenced by the load, P, in the 1st span.

Considering the part on the right of a section in the 3d span as a free body, we have—

$$M_3' = q\left(\frac{l - z}{2}\right)^2,$$ which is a maximum for $l - z = l_1$; hence,

$$(M_3')\text{max.} = q\frac{l_1^2}{2} \quad \text{(11)}$$

When x has any value greater than l and less than $l_1 + l_2$, that is, when P is in the 2d span, we have—

$$M_1'' = q\frac{z^2}{2} \quad \text{(12)}$$

M_1'' is a maximum for $z = l_1$; hence, $(M_1'')\text{max.} = q\frac{l_1^2}{2}$ ..... (13)

$$M_2'' = q\frac{z^2}{2} + P(z-x) - R_1(z - l_1)$$

$$= q\frac{z^2}{2} + P(z-x) - \left[\frac{w}{2} + P\frac{(l_1 + l_2 - x)}{l_2}\right](z - l_1) \quad \ldots\ldots\ldots\ldots\ldots (14)$$

Equation (14) has a positive and a negative term containing x; the latter being greater than the former, M_2'' will be greatest when x is least, that is, has the value l_1.

$$\frac{dM_2''}{dz} = qz + P - R_1 = q(z - \frac{l}{2}) - P\frac{(l_1 - x)}{l_2} = o \quad \ldots\ldots\ldots\ldots\ldots (15)$$

Substituting for x its value l_1 in (15), we have $z = \frac{l}{2}$, and substituting these values of x and z in (14), we have—

$$(M_2'')\text{max.} = q\frac{ll_1}{2} - q\frac{l^2}{8} \quad \ldots\ldots\ldots\ldots\ldots (16)$$

$$M_3'' = q\frac{(l-z)^2}{2}\text{, which is a maximum for } l - z = l_1.$$

$$\text{Hence, } (M_3'')\text{max.} = q\frac{l_1^2}{2} \quad \ldots\ldots\ldots\ldots\ldots (17)$$

From the symmetry of the beam and loading about the center of the middle span it is evident that—

$$(M_3''')\text{max.} = (M_1')\text{max.}, \; (M_1''')\text{max.} = (M_3')\text{max.},$$
$$\text{and } (M_2''')\text{max.} = (M_2')\text{max} \quad \ldots\ldots\ldots\ldots\ldots (18)$$

Comparing the maximum moments in (5), (9), (11), (13), (16), (17), and (18), we see that (M_1')max. is largest; that is, the greatest bending moment which can ever occur in any part of this beam for any position of the moving load, P, is at the supports, and is given by equation (5).

Case II—A Uniformly Distributed Moving Load.

Let the notation be as in case I, except that w = the intensity of the moving load, and x the portion of the beam covered with the load, measured from the left end of the beam.

Taking moments about the left end of the beam, we have—

$$R_1 l_1 + R_2(l_1 + l_2) - q\frac{l^2}{2} - w\frac{x^2}{2} = o \quad \ldots\ldots\ldots\ldots\ldots (19)$$

From Σ(vertical forces) $= o$ we have—

$$R_1 + R_2 - ql - wx = o \quad \ldots\ldots\ldots\ldots\ldots (20)$$

Solving (19) and (20), we have—

$$\left.\begin{aligned} R_2 &= q\frac{l^2 + wx^2}{2l_2} - \frac{l_1}{l_2}(ql + wx) \\ R_1 &= -q\frac{l^2 + wx^2}{2l_2} + (1 + \frac{l_1}{l_2})(ql + wx) \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots\ldots (21)$$

Proceeding as in case I, we have for the moment in the 1st span—

$$M_1' = q\frac{z^2}{2} + wx(z - \tfrac{1}{2}x).$$

$$\frac{dM_1'}{dx} = wx - wx = o, \; x = z.$$

That is, the moment in the 1st span is a maximum when the loading extends up to the section considered.

$$\frac{dM_1'}{dz} = qz + wx = (q + w)z \quad \ldots\ldots\ldots\ldots\ldots (22)$$

The increment in (22) increases as z increases, and is greatest when $z = l_1$. Hence,

$$(M_1')\text{max.} = (q + w)\frac{l_1^2}{2} \quad \text{.......... (23)}$$

$$M_2' = q\frac{z^2}{2} + wx(z - \tfrac{1}{2}x) - R_1(z - l_1) \quad \text{.......... (24)}$$

$$\frac{dM_2'}{dx} = wz - (1 + \frac{l_1}{l_2})w(z - l_1) - 2x\left[\frac{w}{2} - \frac{w(z - l_1)}{2l_2}\right] \quad \text{.......... (25)}$$

Examining (25), we see that the terms not containing x and the coefficient of x are positive; hence, the increment of the moment decreases as x increases, and is greatest when x is least, or zero.

$$\frac{dM_2'}{dz} = qz + wx - (1 + \frac{l_1}{l_2})(ql + wx) + \frac{ql_2 + wx^2}{2l_2} \quad \text{.......... (26)}$$

Substituting for x its value, o, in (26), we have $z = \frac{l}{2}$, and these values of x and z in (24) give—

$$(M_2')\text{max.} = q\frac{ll_1}{4} \quad \text{.......... (27)}$$

$M_3' = q\frac{(l - z)^2}{2}$, which is a maximum for $l - z = l_1$.

Hence, $(M_3')\text{max.} = q\frac{l_1^2}{2}$ .... (28)

For the load covering the 1st span and part of the 2d, we have—

$M_1'' = (q + w)\frac{z^2}{2}$, and $(M_1'')\text{max.} = (q + w)\frac{l_1^2}{2}$ .... (29)

$$M_2'' = q\frac{z^2}{2} + w(z - \tfrac{1}{2}x) - R_1(z - l_1) \quad \text{.......... (30)}$$

Equation (30) has the same form as (24), but x in (30) may vary from l_1 to $l_1 + l_2$, while x in (24) can only vary from o to l_1.

Examining (25), which shows how the increment of M_2' varies with respect to x, we see that, if $l_1 + z^1$ be substituted for z, and $l_1 + x^1$ for x, it reduces to the form $\frac{dM_2''}{dx^1} = -wx^1(1 - \frac{z^1}{l_2})$. This increment being negative, the moment decreases as x increases, and will be greatest when $x = l_1$.

Substituting this value of x in (26) and solving for z, we have—

$z = \frac{l}{2} + \frac{wl_1^2}{2ql_2}$. Hence,

$$(M_2'')\text{max.} = \frac{q}{8}\left(l + \frac{wl_1^2}{ql_2}\right)^2 + \frac{w}{2}\left(l - l_1 + \frac{wl_1^2}{ql_2}\right) - \left(\frac{l_2}{2} + \frac{wl_1^2}{2ql_2}\right)$$
$$\left[(1 + \frac{l_1}{l_2})(ql + wl) - \frac{ql^2 + wl_1^2}{2l_2}\right] \quad \text{.......... (31)}$$

$M_3'' = q\frac{(l - z)^2}{2}$, and $(M_3'')\text{max.} = q\frac{l_1^2}{2}$ .... (32)

When the loading covers two spans and part of the 3d—

$M_1''' = (q + w)\frac{z^2}{2}$, and $(M_1''')\text{max.} = (q + w)\frac{l_1^2}{2}$ .... (33)

$$M_2''' = (q + w)\frac{z^2}{2} - R_1(z - l_1)$$

$$= (q + w)\frac{z^2}{2} - (z - l_1)\left[(1 + \frac{l_1}{l_2})(ql + wx) - \frac{ql^2 + wx^2}{2l_2}\right] \quad \text{.......... (34)}$$

$$\frac{dM_2'''}{dx} = (z - l_1)\left[\frac{w(l_2 + l_1) - wx}{l_2}\right] \quad (35)$$

From (35) we see that the increment of M_2''' is negative, as x varies from $l_1 + l_2$ to l; hence, M_2''' is greatest for $x = l_1 + l_2$.

$$\frac{dM_2'''}{dz} = (q + w)z - R_1 = o.$$

$$z = (1 + \frac{l_1}{l_2})\left[ql + w(l_1 + l_2)\right] - \frac{ql_2 + w(l_1 + l_2)^2}{2l_2} \quad (36)$$

The value of z in (36), and the corresponding value of x substituted in (34), will give the value of (M_2''')max.

$$M_3''' = (q + w)\left(\frac{l - z}{2}\right)^2 \text{ and } (M_3''')\text{max.} = (q + w)\frac{l_1^2}{2} \quad (37)$$

THE EXTRACTIVE YIELD OF VARIOUS IMPORTANT VEGETABLE MEDICINAL SUBSTANCES.

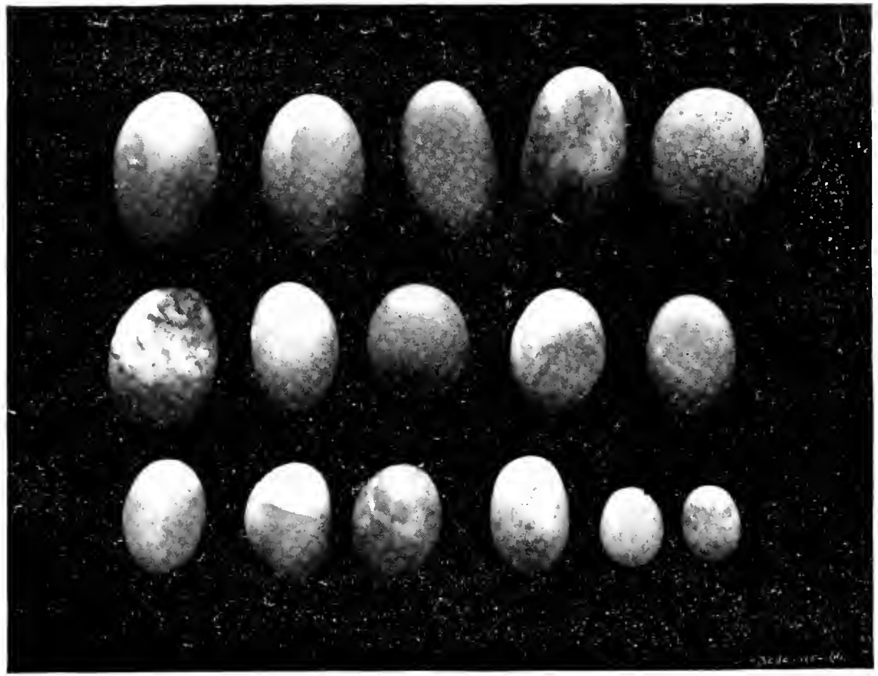
BY PROF. L. E. SAYRE, UNIVERSITY OF KANSAS.

The amount of extractive yielded by a fibrous drug, while it does not afford a sure test of its value, furnishes a data by which the working pharmacist and physician may judge of the quality of the material in hand. It also gives a means by which such adulterations as insoluble woody fiber may be detected. There have not been to my knowledge any reliable tables made out of this kind, and at the suggestion of a few medical colleagues, I have prepared the following table, which is the result of my own examination of the standard drugs of the market.

Table showing the percentage of extractive, dried at 100° C., contained in prominent medicinal vegetable substances of the market.

(The solvents employed being those of the United States Pharmacopœia.)

	Per Cent.		Per Cent.
Aconite	14.15	Hydrangia	9.06
Apocynum cannabinum	14.40	Ipecac root	12.45
Belladonna leaves	22.70	Convalluria	33.50
Burdock root	24.00	Mezereum	11.80
Buchu leaves	23.30	Nux vomica	13.70
Belladonna root	9.65	Podophyllum	13.80
Colchicum root	19.45	Poke root	17.12
Cannabis indica	13.00	Pleurisy root	25.20
Coca leaves	24.70	Stramonium seed	14.10
Conium	28.69	Veratrum	18.00
Digitalis leaves	34.10	Viburnum opulus	15.20
Gelseminum root	11.60	Yerba santa	31.95
Hydrastis	23.20	Juborandi	23.58
Hyoscyamus leaves	19.50		



PEBBLES FROM PLESIOSAUR STOMACH.

From photograph — natural size.

AN INTERESTING FOOD HABIT OF THE PLESIOSAURS.

BY S. W. WILLISTON, STATE UNIVERSITY, LAWRENCE.

In the report on the geology of Kansas in the Frst Biennial Report of the State Board of Agriculture, page 62, by Professor Mudge, occurs the following: "In the Plesiosauri we found another interesting feature showing an aid to digestion, similar to many living reptiles and some birds. This consisted of well-worn siliceous pebbles, from one-fourth to one-half an inch in diameter. They were the more curious, as we never found such pebbles in the chalk or shales of the Niobrara." As a member of Professor Mudge's party, I have a very distinct recollection of the different specimens which afforded these pebbles. The first, found by myself, had, scattered among the ribs, a quart or more of the stones. The others gave a less number, but they were found imbedded in the matrix surrounding the ribs. If my memory is correct, all of the specimens belonged to the genus *Polycotylus*, and were of medium size. The conclusion that the pebbles had been in the stomach of the reptiles was irresistible, and was all the more interesting from the fact, as stated by Mudge, that such stones were entirely foreign, otherwise, to the chalk.

A little over a year ago, the University museum received from Mr.———, of Ellsworth, Kas., a large plesiosaur vertebra and, with it, a rounded pebble, with the request for information concerning both. At the first opportunity, I visited Ellsworth, and, in company with Mr.———, examined the locality whence they had been obtained. the bones were found in a poor state of preservation, from the effects of frost, but, by carefully digging over the loosened shale and soil in which they were contained, we succeeded in securing about 125 of the pebbles, together with a number of characteristic bones. Some of the pebbles were attached by the original soft limestone matrix to the ribs and thoracic vertebræ, so that that there could not be a shadow of doubt of the contemporaneity of deposition. So remarkable had these strange pebbles appeared to those persons who had visited the locality, that many had been carried off as keepsakes, and were called "gizzard stones." It was estimated that, first and last, but little less than a peck of them had been found.

The saurian is one of the largest of the order, measuring, when alive, probably not less than 50 feet. Its specific, or even generic, determination is difficult at present, owing to our lack of knowledge of the allied forms. I believe, however, that it will prove to be a *Trinacromerum*. The pebbles are, all of them, extremely hard, consisting almost wholly of silica. They vary in weight from less than 1 gram to 170 grams, and in their greatest diameters from about one-fourth of an inch to over three inches. In color they are all conspicuous, either white, black, or pink, and all show a great amount of abrasion. The smaller ones have been worn into more or less perfect ellipsoids, and all are quite smooth. The larger ones have rounded angles, indicating a less amount of abrasion.

The pebbles undoubtedly formed a part of the contents of the stomach of the saurian, and had as certainly been gathered up by the animal from the distant beaches of the Benton sea. Professor Mudge states that many reptiles have this habit of swallowing stones; but in this, I think, he was in error. Certainly no other reptiles of the Kansas cretaceous have ever presented any evidence whatever of a similar habit, and, I think, among living reptiles few, except the crocodiles, are known to do so. The reptilian stomach never presents the strong, muscular structure of the gallinaceous birds, which thus use hard substances as an aid to digestion.

At first sight, it will seem remarkable that so monstrous an animal could have retained in its alimentary canal solid objects so small as are some of these pebbles. But it is known that the crocodiles have a peculiarly small pyloric orifice, wholly preventing the passage of solid bodies, and all such, when taken into the stomach, whether bones or stones, must necessarily be digested, or worn down to an extremely small size, before passing into the intestinal canal. In this respect the pebbles show conclusively a similar disposition of the parts in the plesiosaurs. The food of the plesiosaurs must necessarily have been, from the comparatively small size of the mouth and the absence of any special means to aid in deglutition, the smaller animals that abounded in or upon the water, and this fact may perhaps account for the need of a more active digestion. Certainly nothing short of a small stone quarry would have given material aid to the digestive forces of the mosasaurs.

Not the least interesting fact connected with these pebbles is the indication they present of a color sense on the part of the reptiles, or, at least, that they selected the most conspicuous ones. It has been suggested that the stones might have received their shape from the action of the water, and that they, hence, need not have been long in the animal's stomach. This, however, is highly improbable; there is too much uniformity of shape among the smaller ones to have been caused by the action of water. Furthermore, it would have been hardly possible for the animal to have picked up such small stones as many of them are, and it is very evident that the stones were not accidentally swallowed. It is very probable that the pebbles originally were nearly the size of one's fist.

Yet more interesting is the light that is thrown upon the geography of the Benton sea at the time of the animal's existence. The red quartzite is apparently identical with that from Sioux City, and it is Professor Haworth's opinion that they all came from this region, or the region of the Black Hills. This is interesting both as indicating the shore lines at that time and the roving propensities of the animals.

THE DESCENT OF FACIAL EXPRESSION.

BY ALTON H. THOMPSON, TOPEKA, KAS.

It is not a very flattering reflection, perhaps, that the major part of our boasted human nature is animal in its origin, development, and leading characteristics. We talk loftily of our elevation and superiority, and boast of the wonderful things our species has done, and of our wonderful intellectual accomplishments; and they are wonderful, but by a measure we do not like to apply—*i. e.*, by comparison with the greater line of animal ancestry which lies so close at our backs, rather than with the briefer human lines since our emergence from the animal stage. It is because we are so nearly animal yet that our advancement is, in many respects, so wonderful. We admit that our physical organization is entirely animal, and that our moral nature is largely animal yet in its instincts; for it has not thrown off the thraldom it yet endures, of the long æons of savagery and animalism from which we have but lately emerged. Indeed, the brief historic period has done but little to release us from the savage influences of our prehistoric ancestry. By special effort, perhaps, under the powerful influence of religious or other emotions, some few minds have been emancipated from this slavery completely, and others again but in part. Some of these become the pilots of their race in their struggle toward a higher and better life. These are the saviors of mankind, which are lifting the race upward into a higher moral atmosphere. But the task is Herculean, for the legacy of primitive morals is continually dragging it backward into the mire. But intellectually we are, of course, far in advance of our animal and savage ancestors, and are vastly removed from them, so that, mentally at least, civilized man bears but little resemblance to his lowly ancestry, and is quite another creature.

These high mental qualities are, however, resident in a body that is distinctly animal, although in its highest development the mind has had great influence in refining and beautifying the place of its residence. Especially has it refined and beautified the face, as the special seat of the outward expression of the mind and he emotions.

As the various parts of the face have, by the progress of gradual evolution of mind and body together, become the seat of special expression, we wish to notice some of the varieties presented by the features of the human face and their various expressions, and trace some of them back to their animal origin. This will, we trust, aid in the explanation, in a degree, of the extensive variation found in the faces and features of men, and of the endless differences that exist between faces, their forms and expressions, as between races of men and between individuals of the same race. We wish at the outset, however, to declare that this investigation is without any wish or even latent desire to detract from the dignity of our common humanity; but that the study is pursued only in a humble philosophic and scientific spirit. It is mainly with an earnest desire to contribute something toward the finding of a scientific basis for the study of physiognomy and expression, of which it at present stands so much in need, that such an effort is made.

We therefore submit our first postulate, that all human faces are but composites, more or less complete, of inherited characteristics that have been accumulating during the slow lapse of the ages. All the animal and human elements of the individual are but the legacies of his ancestry. Faces vary so infinitely; but when we consider that pure races are now unknown, and that intermixture has been the rule since long before the dawn of history, we cannot wonder at the facial variation that exists everywhere. All nations are more or less mixed, and so faces are more or less mixed, being composed of many racial elements. Variations and incongruity of features are mainly due to unequal development, induced by the conflict of different racial tendencies, and the omnipresent power of atavism, causing the reappearance of long-absent peculiarities of feature. This conflict brings about retardation in some features and acceleration in others, just as in various organs and parts of the body, which develop under the influence of the forces directing the evolution of the species. Some features remain more or less embryonic or infantile, and others bear a decided resemblance to primary animal types, especially with the quadrumanous and anthropoid forms. Others again are accelerated and much developed in man, and other features are much reduced, as compared with the lower primates. The quadrumana furnish many suggestions as to the origin of the human features — suggestions which, if followed up carefully, will furnish clues to many intricate problems of human physiognomy. We will therefore try to trace some of the human facial features and expressions back to earlier sources than even the pure races of mankind — back to their shadowy beginnings, their animal origin. To do this we will need to make comparisons with the contemporaneous quadrumana and embryonic facial forms, which show the features in their immaturity, and thereby study the embryology of expression and its descent.

Prof. E. D. Cope has brought this out to some extent in his chapter on "The Developmental Significance of Human Physiognomy." He says: "Many persons possess at least one quadrumanous or embryonic character, and the possession of quadrumanous characteristics by man approximates his form to that class, so far as the evidence goes. He may retain features which have been obliterated in other forms in the process of evolution. Then again, persons whose features possess any infantile characteristics are more embryonic in those respects than are others, and those who lack them have left them behind on the way to maturity. We have here two sets of characters in which men may differ from each other. In one set the characters are those of monkeys, in the other they are those of infants, and some peculiarities are characteristic of both sets. Characters of the face of monkey-like significance are usually the opposite to those included in the embryonic, but in both the facial region of the skull is larger as compared with the cerebral. Man stops short in the development of the face, and is so far embryonic. The Indo-European is the highest in those things which add to beauty, according to his own ideal. Increased size of the cerebrum and retardation of the face is a main characteristic. Quadrumanous indications are found in the lower classes of the most developed races. The status of a race is mainly determined by the percentage of its individuals who do, and do not, present the features in question. Some embryonic characters may also appear in individuals of any race."

Few faces have features that harmonize, and most faces have one or more features that are immature and incomplete, and that are really either quadrumanous or embryonic. A face in which all the features are matured and well developed and harmonious is beautiful because of the proportions and completeness. The ordinary face is generally degraded and unattractive because one or more of its features are incomplete and inharmonious. But to analyze the face properly, its different parts and features must be studied separately, so we will begin with the superior portion of the face, and take first the *forehead*. Professor Cope says (*op. cit.*): "The facial region of the skull is larger in the quadrumana, compared with the cerebral," the latter receding so that "the forehead is not full and prominent and is generally retreating." The low forehead is, regardless of its bearing on mental power, a quadrumanous characteristic, and the opposite, the high, full forehead, is the advanced, the human form. Sloping forehead is not necessarily a sign of mental weakness, but only of the reappearance of a quadrumanous feature, and when it is accompanied by a brown, transversely wrinkled skin and low-growing hair, the resemblance is altogether too suggestive to be pleasant. Still, retreating foreheads may be seen in some most distinguished men, and are no criterion of brain power.

From an embryological point of view, we notice in the fœtus and infant "that the cerebral part of the skull greatly predominates over the facial" (Cope). In the human infant, as in the young ape, the forehead is more full and rounded than in the mature form. In the embryo the forehead is disproportionately bulging and overhangs the face, so that a mature forehead that is too full is, in a sense, an embryonic form — *i. e.*, the proper growth of the face to the type of normal proportions has not been accomplished and the forehead retains its embryonic predominance. Perhaps, however, it is the survival of a quadrumanous form, as the little squirrel monkey of South America has a disproportionately full forehead — fuller than man himself. The embryonic fullness in all the primates may therefore be but the survival of a long-lost lower form, and be itself a reappearance.

Regarding the *eyebrows*, Professor Cope says (*op. cit.*): "The superciliary ridges are more fully developed in the monkeys, so that in man they are embryonic. Man stops short of completeness in the development of the lower face, and is so far embryonic. . . . The orbits of the eyes are smaller, except in a few species, and the superciliary ridges grow more from infancy to maturity than in man." In man the brow is much reduced, and is thus embryonic. In the great anthropoids the superciliary ridges are greatly extended, and in a few of the lower races of man are quite prominent, but in the higher races of man are reduced. They are thus rudimentary in man, but in occasional cases there is considerable development of the brow, so that it shelves outward like the anthropoids, which is a reappearance. The temporal ridges, as well as the sagittal ridge, are much developed in some of the anthropoids, as the gorilla, for the more extensive attachment of the temporal muscles, for giving greater power to the jaw. These ridges give a depressed appearance to the forehead, and a savage look. There is no reappearance of these ridges in man, unless it should be in an occasional example of the Mongoloid, Malay, or American Indian skulls, but it is very rare, and is perhaps only an anomaly.

"In infancy (Professor Cope, *op. cit.*) the superciliary ridges are not developed, and remain reduced through life," and their condition in the adult of mankind is therefore embryonic ; the low eyebrow is merely an undeveloped feature.

The *eyes* are larger proportionately in the infant than in the adult, and are more prominent, the surrounding parts being undeveloped. With growth the eyeball recedes, owing to the bony socket developing about it. As compared with the quadrumana, the eyes differ but little as to external appearance and form. There may be a difference as to prominence or depression, but this is scarcely perceptible as between man and the monkeys and apes. Individuals vary greatly in all tribes and species. There is a great difference, however, as to the intellectual fire that lights the eye — the indefinite something that reflects the soul behind it. In this, as in his whole intellectual being, man is removed from the lower forms of life by a space whose vastness cannot be estimated.

The *nose*, Professor Cope says (*op. cit.*), "is without bridge in the quadrumana, and with short and flat cartilages. . . . The character of the prominent nose in the Indo-European man, with its elevated bridge, is a sort of acceleration, since it is a super-addition to the quadrumanous type from both standpoints of quadrumana and embryology, and is chiefly due, no doubt, to the greater development of the front of the cerebral part of the skull or ethmoid bone, which, developing later, carries the nasal bones forward with it. . . . In the negro the nose is flat, without a bridge, which is a quadrumanous character, and is a retardation of growth. . . . In the Bushman the flat nasal bones are coössified with the adjacent bones, as in the apes. . . . In the Mongols the nose is flat, with a bridge. . . . Many people, especially those of the Slavonic races, have more or less embryonic noses." Many races have the flat nose, with low bridge, or the bridge may be totally absent. Many individuals of the higher races have flat noses. but the bridge is, if normal, always present.

In the infant "the nose is without bridge and the cartilages are flat and short — quite quadrumanous, in fact." But the nose grows and develops more than any other feature of the face in the progress toward maturity. A well-developed — a "strong"— nose is a strong feature, and strengthens the face, gives character and force. but a small nose is a weak feature and makes a face appear weak. Many adult noses are small and undeveloped, are really "baby noses," and detract much from the beauty, harmony and impressiveness of the face. A noble face with a small, insignificant nose cannot be imagined. It is the imperial feature, and dictates the character of the face. A small nose is embryonic, and has stopped short in its course of development at an immature stage. It does not really mean weakness in character. however, but only that the face has inherited a past form and did not reach the full attainment of its type, and the result is inharmony and mediocrity. The omnipresent mediocrity of the sea of faces around us is due largely to the prevalence of immature noses.

Then again, many noses of to-day are distinctly quadumanous in some of the characteristics which they retain. The anthropoid nose is flat of bridge and crushed upward against the face, flattened and "stub nosed" in fact. This form is seen in many "stub" noses — "*retrousse*," if you please — where the nose is distinctly upturned and retracted, as often occur in Celtic. Negroid and Slav races, and sometimes in others. In the negro the wings are spread and enlarged also, as in the monkeys. Again, the American monkeys have noses with wide basés, with the nostrils set well upon the side; hence their name, *Platyrrhine*, wide nosed. The old-world monkeys have the nostril openings set close together beneath, and are called *Catyrrhine*, or narrow nosed. Now, it is not unusual, especially among negro and other low races, to see an approach to this wide-nosed form — a wide pillar between the nostrils, and the latter openings set more or less on the side of the nose. A slight approach to this is seen in very many individuals of the European races, and occasionally an instance that is quite pronounced. This is an inheritance — an interesting survival of a very low form, a form which even the old-world monkeys have passed over.

These survivals, or rather reversions, are interesting as showing that this important feature, when not typically developed in man, is only immature. It is an interesting organ also, in that its normal development in man is superior to that of other animals, and is due to accelerated growth. A fine, strong human nose is an acquirement of our species since its emergence from animalism.

By excessive and abnormal development the nose often simulates the proboscis of other animals, but the resemblance is merely accidental. Yet the physiognomists have made much of these resemblances as indicating the character of the individual — that it resembled the animal thus simulated. This is, of course, absurd; but the idea was quite popular in certain circles in former days. It was part of the old physiognomy.

Regarding the *cheeks* — the malar bones, the zygoma, etc. — Professor Cope says (*op. cit.*): "The cheeks are more prominent in the quadrumana. . . . In the negroid and Mongolian races the malar bones are quite prominent, which is a quadrumanous accelerated character. The malar bones are reduced in the Indo-European races, which is a retardation, and is an embryonic condition." Most low races have prominent cheek bones, and this peculiarity is usually an accompaniment of a low physical and mental stage. In the higher races the cheek bones are much reduced, so that the occasional reappearance of the high malar prominence among them detracts at once from the elevation of a face. Indeed, high cheek bones make a low face, and are a distinctly quadrumanous inheritance. So we find this feature prominent and conspicuous in most low races, and reduced and inconspicuous in the higher races — at least in the Indo-European races, which *we* are disposed to call the highest of mankind.

The reduction of the cheek bones in the higher races is not merely an accidental embryonic condition, such as occurs as a freak in the nondevelopment of the nose, for instance, so far as the individual is concerned; for "in the infant the malar bones are not prominent," and their retardation is a later human characteristic and their acceleration a quadrumanous characteristic. There is a peculiarity of the cheeks, however, that is often retained to maturity that is embryonic and a distinctly infantile feature, and that is the enlargement of the buccinator, the "sucking" muscle. The strong development of this muscle in the infant, for physiological purposes, gives the cheeks of the infant their excessive fullness, which, when the food habits change, become reduced by disuse (and inheritance) and the cheek falls in, making the face thinner. The retention to maturity of excessively full cheeks, of the fleshy part, is an embryonic feature, and gives to the face an infantile look. Yet a moderate fullness is much to be desired, as plump cheeks are the inseparable adjuncts of symmetry and beauty of the face.

Regarding the *jaws*, *mouth*, and *lips*, Professor Cope says (*op. cit.*): "The jaws in civilized man are so much retarded in development as to be quite embryonic as compared with those of the monkey and some of the lower races of man. Many of the latter are quite prognathous, and thereby approach the quadrumanous type: but civilized jaws stop short of the full development of the anthropoid form. That is, in the monkeys the jaws are more prominent than in man, and as this results from a fuller course of growth from the infant, it is evident that in these respects the apes are more fully developed than man. The reduced jaws are characteristic of retardation. In the negro and Mongolian we notice that there is a predominance of the quadrumanous features (prognathous jaws) which are retarded in the Indo-European; and that the embryonic characters which predominate in the last (orthognathous jaws) are more accelerated in the others. In the negro the edges of the jaws are prominent—a quadrumanous characteristic; in the higher races the alveolar borders are reduced. . . . The edges of the jaws are more prominent in the quadrumana. . . . In the monkey the jaws grow more from infancy to maturity than in man." Prognathism is a quadrumanous character, and its opposite, orthognathism, a human character. The teeth project in most low races, and are more vertical in most civilized races, and this adds to the character of the jaws, whether prognathous or orthognathous. These characters are very constant as racial features, there being but infrequent individual deviation from the racial type, and perhaps only in the higher races, in the cases of congenital idiots, who sometimes have prognathous jaws, owing largely to the nondevelopment of the brain case. Darwin says ("Descent of Man"), quoting Vogt: "Microcephalous idiots have a smaller brain, less complex convolutions, the frontal sinus is largely developed, the jaws are prognathous to an *effrayant* degree; so that these idiots somewhat resemble the lower types of mankind." Indeed, prognathism and a small brain case, or orthognathism and a large brain and prominent forehead, bear a constant relation to each other. In the higher races, with greater mental power, the brain is larger—at least the fore brain—and causes the brain case to grow forward and overshadow the jaws, which are correspondingly and synchronously reduced. And, *vice versa*, prognathous jaws project forward of the brain case, which is reduced and smaller. Thus it is that small, orthognathous, vertical jaws and large brain go together, and large, prognathous jaws and small brain together, as more or less constant racial characteristics.

"In the infant the alveolar borders are not prominent. . . . The faces of some people are partly embryonic," in having a short face and light lower jaw. Such faces are still more embryonic when the forehead and eyes are prominent. "Retardation of this kind is most frequently seen in children, and more frequently in women than in men." An undeveloped, retracted lower jaw is an embryonic form sometimes seen.

In the quadrumana "the mouth is small and the lips thin. . . . The strong, convex upper lip, as frequently seen among the lower races of Irish, is a modified quadrumanous character" (Cope, *op. cit.*), and is quite constant in their descendants. The lips are distinctly cleaner and finer cut in the higher European races than in the lower races of man, and the oral opening is smaller. A large, wide opening to the mouth, with coarse lips, is a low type, and, when associated with depressed corners, is positively quadrumanous. These forms are often seen in low races, and sometimes reappear in individuals of the higher races. The lips are coarse and shapeless in all low races, and the finely-carved lip is a distinct mark of superior organization. In the quadrumana the lips are thin and infolded, showing but little of the mucous membrane. Thus, a mouth that is wide and much depressed at the corners, with thin lips and a long, stiff upper lip, is positively quadrumanous. The inheritance is direct. The thick lip, that shows much of the mucous membrane folded outward, is embryonic. It is infantile, and remains as a permanent feature in most lower races, and in some individuals of the higher races. It is the remains of the nursing period, like the developed buccinator muscle.

"The chin is retreating in the quadrumana, . . . and a retreating chin in man is a marked monkey character" (Cope. *op. cit.*); that is, a chin that is retreating from the alveolar border backward, as a normal condition, and not as a result of the accidental lack of development of the lower jaw, or a lingering embryonic form. The lower jaw is somewhat inconstant, and may be very small or very large as compared with the rest of the face, leading to malposition and irregularity of the teeth, as frequently observed by dentists, and the complete alteration of the expression of the mouth. But the chin, as a distinct feature, is independent of the form of the jaw, and occurs as a part developed upon and added to it—the part known as the bony symphysis of the lower jaw. It is a powerful and expressive feature in man, and serves much to give character and impressiveness to the face. A bold, strong chin gives strength to a face, and a weak, retreating chin weakens a face as much as a weak, embryonic nose.

The chin is a distinctively human feature. Mivart ("Man and Apes") says: "A striking feature of the human skull is the prominence of the inferior margin of the lower jaw in front, *i. e.*, the presence of the chin. The feature is quite wanting in the gorilla, orang, and chimpanzee"—in fact, in all the quadrumana, except a slight approach to it in the siamang. This is easily observed by comparisons of the skulls of monkeys and man. Even the lower races of man have, as a rule, retreating chins, especially when there is prognathism present, and, like that, it is a quadrumanous feature.

The descent of the *movements of expression* is an interesting part of our subject and opens a wide field, the study of which may enable us to find the origin and trace the descent of many of the expressive movements of the face of man. We notice first that many animals express emotions by the motions and movements of parts which with man have become obsolete or were never used by his ancestors. Thus, the horse expresses his feelings—anger, fear, etc.—most plainly with his ears; the expressive organ of the dog is the tail; the cat expresses her feelings by the arching of the back and the movements of the tail and ears, and the standing hairs are expressive in both cat and dog. There are other expressive movements that lie outside of the facial features, but with these we will have nothing to do at present. The eyes are expressive in all animals, and in that they much resemble man.

Facial expressions, the movements of the face, were undoubtedly developed with the growth of the mind, as new emotions and mental faculties were called into existence which demanded expression. The first expression of the feelings or of the ideas was sign language, and facial expression remains with man as a rudiment of that means of communication, before the origin and development of language, for sign language is used even by animals, in expressive movements of different parts of the body, which are well understood.

Charles Darwin says ("Expression of the Emotions in Man and Animals") that he "attended as closely as possible to the expression of the several passions of animals, as affording the safest basis for generalizations on the causes or origin of the various movements of expression. . . . It seems probable that the habit of expressing our feelings by certain movements, though now rendered innate, had been in some manner gradually acquired." Again he says ("Descent of Man"): "The relative position of our features (as compared with the quadrumana) is manifestly the same, and the various emotions are displayed by nearly similar movements of the muscles and skin, chiefly above the eyebrows and around the mouth. Some few expressions are, indeed, almost the same, as in the weeping of certain kinds of monkeys and in the laughing noise made by others, during which the corners of the mouth are drawn backward and the lower eyelids wrinkled. The external ears are curiously alike. In man the nose is much more prominent than in most monkeys;

but we may trace the commencement of an aquiline curvature in the nose of the Hooloch gibbon, and this in the *Semnopithecus nasica* is carried to a ridiculous extreme."

Or again, Darwin says ("Expression of the Emotions"): "When animals suffer from an agony of pain, they writhe and utter piercing cries and groans. With man the mouth may be closely compressed, or the lips retracted and the teeth ground together. Many animals grind the teeth in pain. When a chimpanzee is pleased or being tickled, a decided chuckling or laughing sound is uttered, the corners of the mouth are drawn backward, and the lower eyelids may be slightly wrinkled, but the teeth are not exposed. Their eyes sparkle and grow brighter. Young orangs, when tickled, likewise grin and make a chuckling sound, and an expression like a smile passes over the face. . . . When given a choice morsel, the corners of the mouth are raised in a slight smile of satisfaction. The same movement expresses pleasure in meeting a person to whom the monkey may be attached." Dogs often retract the corners of the mouth and raise the lips when pleased, or when displaying affection or delight. "In anger or fear, the lips of the monkeys are sometimes drawn up and the mouth opened and closed to show the teeth," to frighten the enemy by threatening biting. "Some species, when irritated, part the lips and gaze with a fixed and savage stare. Then the crest of long hairs on the brows may be drawn backward," and the brows be raised and lowered rapidly. "Some species of monkeys expose the teeth, others purse the mouth so as to conceal them, or pout the lips forward. Indeed, the movements of the features are really the same as those from pleasure; . . . others grow red in the face when enraged: others move the eyebrows rapidly up and down when excited. . . . Young orangs and chimpanzees protrude the lips greatly also when displeased. Young orangs often kiss each other. . . . The higher apes raise the eyebrows, and the forehead becomes, as with man, transversely wrinkled. In comparison with man, their faces are less expressive, chiefly owing to their not frowning under many emotions of the mind. Frowning, which is one of the most important of all the expressions in man, is due to the corrugating muscle of the forehead; but though the apes possess this muscle, they rarely frown, at least conspicuously. . . . The gorilla, when enraged, erects the crests of hair, depresses the lower lip, and utters terrific yells. The great power of movement of the scalp of the gorilla and of some other of the quadrumana demands notice in relation to the power still possessed by some men, through inheritance by reversion or persistence, of voluntarily moving the scalp. . . . Astonishment is not expressed by wide-open mouth by the monkeys, as with man."

In summing up his observations, Mr. Darwin says: "That the chief expressive actions exhibited by man and the lower animals are now innate and inherited—that is, have not been learned by the individual—is admitted by every one. So little has learning or instruction to do with some of these, that they are from the earliest days and throughout life quite beyond our control. . . . Many of our most important expressions have not been learned; but it is remarkable that some, which are certainly innate, require practice in the individual before they can be performed in a full and perfect manner. . . . Slight movements, such as the wrinkling of the forehead in grief, or the scarcely preceptible drawing down of the corners of the mouth, are the last remnants or rudiments of strongly marked and intelligible movements. They are full of significance to us in regard to expressions, as are all ordinary rudiments to the naturalist in the classification and genealogy of organic beings." Then again, many movements of the face in lower forms are but the beginnings, the embryonic origin, of expressions that are highly developed in man, as, for instance, the action of laughing. Of this movement we can see but the beginning, the suggestion, in lower animals. Indeed, man has been described as "the only animal that laughs," for he alone gives the movement full play. So with frowning, expression with the eye, and other facial expressive movements which are undeveloped in lower forms, but have their origin there.

Then again, the higher grades of expression, those expressions of the higher emotions and intellectual processes, must have arisen after the emergence of man from the animal stage, as the animals furnish us few suggestions of them, or of the probable source of their origin, or path of development. Such expressions are the human part of the face—that which lifts it beyond and sets it apart from the animals below it. Under this head come the finer expressions of the mouth and face, which accompany that highest intellectual accomplishment, intelligible speech. Man does not indulge in the coarse movements of the mouth, as excessive pouting or strong retraction of the lips, showing the teeth, etc. (except when under very strong feeling, or as children, who employ such extreme actions), but the mouth is more under restraint, and expresses the finer grades of feelings and emotions which have come into existence since man became a different being, and to which the lower animals are strangers. The acquisition and development of articulate speech has led to the modification of some animal expressions and the refinement of others, and the creation of still others entirely new. But the differentiation of these is impossible in the present state of imperfect data and absence of close observation. The study of comparative expression opens up a field that is very inviting and would be fruitful of results to the careful observer.

But, of the philosophy of expression, Mr. Geo. Romanes says that "in animals as in man there is obviously a 'logic of feelings' that is translated into a 'logic of signs.' This logic of signs, in its higher development, has exclusive reference to the representative faculties, and is first evoked by those exigencies of life which rendered necessary the communication of ideas. The germ of the sign-making faculty occurs among animals as far down as the ant, and is highly developed among the higher vertebrates. Pointer dogs make signs, terriers 'beg' for food, and the cat, dog, horse and other animals make signs. The animal is capable of converting the logic of feelings into the logic of signs for the purpose of communication, and it is a sign language as much as that of the deaf-mute or savages." From these beginnings the principle of communication arose, signs and gesture language were developed, and facial expression, as an auxiliary of gesture language, was evolved.

Facial expression is, then, in its last analysis, sign language. It belongs to the realm of "gesture speech"—communication by gestures of the features. As Mr. Garrick Mallery says, in his contributions to the study of sign language (Report of Bureau of Ethnology, Vol. I), "Gesture speech is divided into corporeal motion and facial expression. . . . A play of features, whether instinctive or voluntary, accentuates and qualifies all motions intended to serve as signs, and strong instinctive facial expression is generally accompanied by action of the body or some of its members. But, so far as distinction can be made, expressions of the features are the result of emotional and corporeal gestures of intellectual actions. The former in general and the small number of the latter that are distinctly emotional are nearly identical among men, for physiological causes which do not affect with the same similarity the processes of thought. The large number of corporeal gestures expressing intellectual operations require and admit of more variety and conventionality. . . . Sign language necessarily includes and presupposes facial expression when the emotions are in question. . . . The earliest gestures were doubtless instinctive and generally emotional, preceding pictorial, metamorphic and conventional gestures, which in turn preceded articulate speech, according to Darwin. . . . While it appears that the expressions of the features are not confined to the emotions, the movements of the hands or arms are often modified or accentuated by associated facial changes. These infuse life into the skeleton sign and belong to the class of innate expressions. . . . Emotional expression in the features of man is to be considered in reference to the fact that the special senses either have their seat in or in close relation to the face, and that so large a number of nerves pass to it from the brain." He describes several instances where complete conversation has been carried on by facial expression alone, showing the possibilities of intellectual as well as of emotional expression of the face.

Facial expression differs from sign language in that the latter, like oral speech, has become conventional among tribes by whom it is extensively employed; but the former still bears its primitive graphic and representative relations to thought and feeling. It pictures feeling, illustrates thought, and is, therefore, the remains of the original, primitive sign language, which was pictographic. Sign language and its analoge, facial expression, "are so faithful to nature that they will endure, while vocal speech will undergo many vicissitudes of development and retrogression." Being among the earliest evolved expressional habits, facial expression will be among the last to change, while oral speech and our sign language will become conventionalized, and undergo many changes, so as to lose all resemblance to idiographic signs. Facial expression is part of the natural sign language, and consists largely of hereditary impulses left over from a primitive state. So the signs given by the features, indicative of what is going on within the mind, are direct and simple. Even children — babies — notice the expressions of the face, and judge of the intentions of persons toward them. The power to read signs is of course an hereditary instinct, just as the sign language of the face is hereditary. Both came down from an epoch in the evolution of the race when articulate speech was undeveloped and even gesture language was unconventionalized.

NOTES ON THE CORN-ROOT WORM.

(*Diabrotica longicornis* Say.)

BY S. J. HUNTER, WAVERLY, KAS.

This corn pest has been known in the State for 10 years. The following notes, comprising my observations of this year on the workings of the pest in a single locality, reveal the very considerable damage which may be done by the pest. If the corn-growing region of the State were generally so badly infested, the loss would be enormous.

My observations were made in the northeast corner of Anderson county. The pest was first noticed in the neighborhood three years ago, on a farm bordering on Franklin county. Mr. Guard, the owner of the farm, stated that the insects have been increasing each year, so that this year his corn will not average more than one-third of a crop. One-half mile south of this farm there is a ridge of high prairie land four miles long, running east and west. On the west end of this ridge Mr. Stidham owns a farm. Mr. Stidham said he had not noticed the pest in his corn until this year. About the middle of June the corn on 30 acres of his land stopped growing and began to turn lighter in color. Upon examination, he found a worm at work at the roots, cutting each of the roots off at about two inches from the stalk. The "bite," he said, in every case seemed to poison the rootlet so that a kind of tubercle formed on the end, and no further growth took place from the rootlet. The worm he described as white, very short and slender when young, but when grown it was one-half an inch long and of yellowish color. This piece of ground he had planted in corn for five years consecutively. He thought the worm had destroyed two-thirds of the crop. Mr. Stidham did not know the life history of the worm, but, from the great number of little green beetles in his corn, concluded they were the parents of the worm.

A short distance to the east, on the same ridge, Mr. J. L. Garrett had 12 acres attacked. This piece, according to his estimate, will not average two bushels to the acre. A piece of corn near by, not badly infested, will yield 25 bushels per acre. Mr. Grandin, another resident of the ridge, had 15 acres so badly damaged by the pest that the field, on the 1st of September, looked as it might after a heavy hail storm. Very few stalks could be found standing firmly in the ground. Mr. Grandin thought he would not obtain one-third of a crop.

These are the worst cases along this ridge, but every farm along the ridge has the insect in its soil. Some of the farmers said the pest destroyed an acre; others that they had noticed it in their corn, but not in great numbers.

About 1¼ miles southwest of this, a 30-acre piece of corn was similarly attacked. This ground is bottom land, has raised corn five years consecutively, and has until this year produced about the best corn in this locality. It will not yield this year two-thirds of a crop. One-half mile southwest of this, Mr. Olendorf has 14 acres of corn which has been about half destroyed by the pest. Mr. Olendorf is the only man in the neighborhood who has had previous experience with the insect. He stated that nine years ago they destroyed about two-thirds of the corn crop of Carroll county, Missouri. He said they could not seriously damage corn planted in ground for the first time after some other crop; that corn must be planted from three to five years consecutively before they could work effectively.

On 35 acres of corn near by, the writer had an opportunity to watch the working of this insect from the first of August until the first of October. After the corn was "laid by" it grew quite unevenly. Just as the tassels appeared above the top leaves of the stalk, numbers of grass-green beetles, about four-tenths of an inch long, head and prothorax reddish brown, began to enter the tassels. Here they fed upon the pollen, knocking it down into the sheath of leaves around the tassel. The mass caused decay around the base of the tassel, and, in some cases, killed the tassel before it had grown to its full height. Twelve of the beetles were frequently found in one tassel. Stalks containing that number could generally be lifted out of the ground with the finger and thumb. All the corn examined was drilled corn, so that it can be inferred that the insect ascends the stalk on whose roots it has fed when in the larval state.

After the pollen has gone, the insects can be found between the husks of the ear, and also between the green leaves and the stalk. They are very active, and seek flight upon the slightest disturbance. In flight, they resemble a particle from the tassel, or a small piece of corn leaf; so that one might examine a stalk with several insects on it and, unless they were seen before taking wing, might suppose there were no bugs on the stalk.

From observation and reports from farmers, the following may be said: The insect probably passes the winter in the egg laid in the field the previous fall, hatches out about the middle of May, in the form of a white worm, one-quarter of an inch long and as thick as a pin. In this form it fastens itself to a corn rootlet, cutting it off, then continues to encircle the stalk until all the rootlets are cut or until it has become full fed. At this stage it is about one-half inch long, and yellowish white. Now it becomes a pupa, and appears at tasseling time as a grass-green or yellowish-green beetle, ready to feed upon the pollen. Thus it is destructive to both the root and the top of the corn. It works best in ground which has produced corn for several years in succession. It is more destructive on high prairie land than low land, in dry seasons than in wet seasons. On the bottom farms mentioned, the damage was in spots where the soil was exceptionally loose. No artificial remedies have been used in this vicinity.

ON THE HORSE FLIES OF NEW MEXICO AND ARIZONA.

BY C. H. TYLER TOWNSEND, NEW MEXICO AGRICULTURAL COLLEGE, LAS CRUCES, N. M.

Horse flies rarely occur on the higher lands or mesas of New Mexico and Arizona, so far as my experience goes, unless in proximity to some swale, spring, or body of water. They are met with in valleys of rivers and streams, and some species occur very abundantly in the neighborhood of isolated swales or marshy places filled with a growth of tall grass or various plants. Such swales occur at long distances from each other in some parts of this region, as in eastern-central Arizona, and may or may not be situated near to a creek or spring. They are usually filled with the carcasses of dead cattle, which have been unfortunate enough to get mired in them, and in such cases yield a most offensive odor.

This distribution of the horse flies is the result of the nature of the country, where water holes and springs are few and far between. It is quite possible that most of the species breed in these swales, but doubtless the prime reason for their occurrence near water is because the animals whose blood they suck are to be found there only.

The following species have been collected by the writer in this region:

Chrysops fulvaster O. S. ♂ ♀
Silvius quadrivittatus Say. ♂ ♀
Apatolestes comastes Will. ♀
Diachlorus guttatulus n. sp. ♀
Tabanus punctifer O. S. ♂ ♀
Tabanus lineola Fab. ♂ ♀
? *Tabanus vivax* O. S. ♀

Below are given notes and descriptions of the species:

Chrysops fulvaster Osten Sacken.—Seven ♀ specimens and one ♂ from G bar ranch, Zuni river, Arizona, July 27 (Apache county). One ♀ from Pescado, N. M., July 31 (Valencia county). One ♀ from Springerville, Ariz., June 24 (Apache county). Seven ♀♀ from Seneca ranch, north of Springerville, Ariz., June 25 (Apache county). Most of my ♀ specimens are 8 mm. in length; the one ♂ is 7 mm. In the ♂ the "subhyaline elongated spot at the distal end of both basal cells," mentioned in Osten Sacken's description, extends into and occupies the central third of the anal cell. There is also present the subhyaline spot in the middle of the fifth posterior cell, as in the ♀; and the crescent-shaped space toward the apex of the wings, mentioned by Osten Sacken, also present in the ♀. The discal cell is faintly subhyaline in its central portion. With these exceptions, the wing of the ♂ is wholly blackish, if we except a minute subhyaline spot in the extreme proximal end of the first basal cell. Osten Sacken does not mention the antennæ, which are wholly black in the ♂, but blackish with the first joint fulvous or reddish in the ♀. Williston has noticed the swollen first antennal joint, peculiar to this species (Trans. Kas. Acad. Sci., vol. X, p. 134). This species is very annoying to man and horses. It was found very abundantly at a slough near the Seneca ranch, about a half mile south; the slough grassy, and full of reeds and dead cattle. The flies were very bloodthirsty. One was found piercing one of the leather girth straps of my saddle, and another attempted to pierce my heavy overalls. They will fly in one's face, and bite almost the moment they have alighted. They were also extremely numerous at a swale near the G bar ranch, on the Zuni river.

Silvius quadrivittatus Say.—I identify numerous specimens from Las Cruces, N. M., as this species. They are all females, taken from June 10 to September 2. My specimens are from $6\frac{1}{2}$ to nearly 9 mm. Say's description gives nearly $\frac{3}{5}$ inch (nearly 10 mm). In some of the specimens the dorsum of the abdomen is more or less tinged with yellowish, but nearly all have the abdomen uniform silvery cinereous, except the four longitudinal series of brown spots. Say's description was probably from one or more specimens possessing the yellowish tinge. This species is often very troublesome to horses in the Mesilla valley (vicinity of Las Cruces, Doña Ana county, N. M.) It does not seem to attack man in this locality. It was not met with during a trip through northeastern Arizona the past summer. A ♂ specimen, which was taken on flowers near Sabinal, N. M., August 7 (Socorro county), I take to be the ♂ of this species. It differs as follows from the ♀: Only two black facial tubercles, the intermediate third one absent; first antennal joint pale fulvous at base; palpi very small, much shorter than in ♀, very pale fulvous; thorax with a very slight fulvous tinge; abdomen yellowish or orange, more deeply yellow on hind margins of segments, first two segments more silvery; brown markings of abdomen a little heavier; pleuræ, sternum and venter less silvery pollinose.

Apalolestes comastes Williston.—One ♀ specimen taken at Manguitos Springs, N. M., (Socorro county, near the Arizona line,) June 23, I believe belongs to this species. It agrees perfectly with Williston's generic description, and differs from the speeific description only as follows: Palpi grayish; tibiæ brown or blaekish. While the first segment and the hind margins of the other segments of the abdomen may be grayish or brownish gray, and clothed with sparse whitish hairs, the most of the abdomen is clothed with black hairs. The length is same—11 mm.; wing, 9 mm.

Diachlorus guttatulus n. sp.—Female: Face short, whitish, clothed with pure white hair, without eallosities; front quite distinctly convergent anteriorly, yellowish gray pollinose showing more thickly above base of antennæ; frontal callosity black, nearly square, prolonged above in the middle and at each side, the lateral prolongations often cut off, sometimes irregular; an ocellar callosity black, not raised into a tubercle. Antennæ inserted well below middle of head, light brownish, annulated portion of third joint black, the third joint at base having no distinct upper angle. Palpi large, almost as long as proboscis, yellowish white, with very few black hairs. Thorax cinereous, with six longitudinal blackish lines, the outermost one on each side less distinct than the others; sternum and pleuræ clothed with white hair. Abdomen silvery gray pollinose, sometimes with more or less of a yellowish-red tinge, especially on the sides of second to fourth segments; first segment with a posterior transverse submarginal narrow brown band, more or less interrupted in the middle; second with an anterior marginal transverse brown band, thickened in middle, but split from behind so as nearly to be interrupted; segments three to five also showing an anterior brown margin, at least in middle; segments two to six with four posterior submarginal brown spots, those on fifth and sixth segments usually not quite so distinct, spots rarely coalescing. Wings entirely hyaline, stigma very faintly if at all yellowish; all the posterior cells widely open, anterior branch of third vein with quite a long stump near origin. Legs brownish yellow, front femora slightly darker at tip; front tarsi and tips of front tibiæ black, tips of other tarsi brownish; front tibiæ slightly enlarged distally. Length, 9 to 10 mm.; of wing, 8 to 9 mm. Described from seven ♀ specimens, Las Cruces, N. M., June 26 to 29. I have referred this to the genus *Diachlorus* on account of the short face and somewhat swollen front tibiæ, though the face has no callosities, and the eyes, as revived over wet sand.

do not show the very oblique, nearly vertical stripes mentioned by Osten Sacken (Prod. Mon. Tabanidæ, vol. I, p. 396), but have them nearly horizontal. The arrangement of the bands is as follows: Eyes green, with four slightly oblique purplish-bronze bands, the lowermost one forming the lower border of the eye, and the uppermost one being some distance from the upper angle of the eye.

Tabanus punctifer Osten Sacken.—This is a large black species, with a tan-colored thorax, which is found more commonly throughout this region. It attacks horses and cattle. One ♀, Las Cruces, N. M., June 9; one ♀, Fort Selden, N. M., June 13 (Doña Aña county); two ♀♀, La Vega de San José, N. M., August 4 (Valencia county); one ♂, Chaves, N. M., August 6 (Valencia county); also, one ♂, Grand Cañon of the Colorado river, Arizona, Hance trail, about 4,000 feet below rim of cañon, July 11 (Yavapai county).

Tabanus lineola Fab.—Four ♀♀, Las Cruces, N. M., May 20 to June 4; and one ♂, Las Cruces, N. M., May 23. This species is quite frequently found on horses here.

Tabanus vivax Osten Sacken.—One ♀, taken in the Grand Cañon, Hance trail, about 4,000 or 5,000 feet below rim, July 11 (Yavapai county), agrees very well with Osten Sacken's description of the ♂ of this species (the ♀ is not described). (See Prod. Mon. Tabanidæ, vol. II, p. 446.) It is only 12 mm. in length, and may be a distinct species; but I do not feel competent to decide on this point without more material. The palpi are whitish rather than reddish, and the bases of the tibiæ are rather yellowish than reddish. The frontal callosity is rounded in outline above, very black, and polished; the face is short, the antennæ being inserted low; the eyes, revived over wet sand, are purplish, with two almost horizontal green bands but little below middle of eye, the upper angle of eyes blackish; or, the eyes may be described as having two green and three purplish bands, the lowermost purplish band forming the lower border of the eye, and the uppermost purplish band bordering the black, upper angle.

ON A PECULIAR ACALYPTRATE MUSCID FOUND NEAR TURKEY TANKS, ARIZONA.

BY C. H. TYLER TOWNSEND.

While on a trip by wagon the past summer to the Grand Cañon of the Colorado river, a peculiar dipterous insect was met with in numbers, July 1, in a certain restricted locality, a few miles west of Turkey Tanks, Ariz., on the road to Flagstaff. The insects were found somewhere near the center of a large open stretch of meadow-like country, probably about three or four miles from the Tanks, and about 10 miles from Flagstaff. They were evidently flying, as they came in the wagon, alighting on whatever they happened to strike. The locality is probably about five or six miles east of the base of the San Francisco mountains. They occurred for some distance as we drove along the road, probably for a mile or so, and not a specimen was seen at any other place during the whole trip, comprising a drive of over 1,200 miles through southwestern New Mexico and northeastern Arizona. The more remarkable thing concerning this occurrence is, that on our return, while traveling along the same road, July 17, we found the same fly in numbers coming in the wagon at, as nearly as I can say, the very same place along the road. In neither case did I get out of the wagon to capture specimens, as I was able to take plenty of them without this trouble.

The species is very striking in appearance, being of a narrow, elongate form, with very long, slim legs, and an elongate, anteriorly-produced head. These peculiarities are characteristic of the genus *Micropeza*, to which the fly belongs. As it appears to be an undescribed species, it is characterized below.

So far as I can learn, nothing is known of the habits of these flies. The acalyptrate muscidæ whose habits are known breed in decaying vegetable matter and manure (some *Cordyluridæ* and *Helomyzidæ*); in decaying fruits (*Drosophilidæ*); in roots of plants (*Ortalidæ*); in stems of plants (*Oscinidæ*, *Lonchæidæ*, and *Agromyzidæ*); in fruits and seeds (*Trypetidæ*); under decaying bark of trees (some *Heteroneuridæ*); and the larvæ of some live in the water (*Ephydridæ*). Some *Trypetidæ* also make galls. The *Piophilidæ* include the small cheese fly, whose maggots breed in cheese. Certain genera, as *Helomyza*, *Dryomyza*, and *Sapromyza*, breed in fungi; while some *Phytomyzidæ* are leaf miners. Last of all, some genera of the small group *Ochthiphilidæ* are parasitic in plant lice and scale insects. It is quite probable that the present species breeds in the stems of some plant, most likely a grass, but this does not explain its restricted occurrence in such numbers. Such a breeding habit would be indicated by the ovipositor.

Micropeza turcana n. sp.—♀ blackish, ventral portions and sides light yellow. Head greatly elongated, the front conically produced anteriorly. Eyes blackish, elliptical, longitudinal (antero-posterior) diameter greatest. Front yellow, ocellar area black; a black vitta on each side of front on sides of head (occiput) behind eyes; a few small bristles on vertex. Cheeks and face yellow, face extremely receding, almost horizontal, produced into a longitudinal ridge; antennæ and arista black. Proboscis short, fleshy, yellowish; palpi very small, blackish. Thorax blackish above, with two narrow yellow vittæ, broadened before and continued behind on to the scutellum, which is otherwise blackish and bears two small bristles on apex; a pleural stripe from neck to base of wing on each side, and fectus or sternal portion of thorax yellow; portion of pleuræ between yellow stripe and sternum on each side reddish brown, more or less silvery pollinose, forming a band from near neck to origin of hind legs. Abdomen very narrow and elongate, blackish above; incisures narrowly and posterior portion of sixth segment broadly yellow; venter yellow. Seventh segment prolonged into a nearly cylindrical ovipositor about two-thirds the length of the abdomen, somewhat larger at base, light brown, blackish distally. Legs very elongate, especially the middle and hind pairs; coxæ yellow, femora brownish yellow, tibiæ light brownish, their tips and tarsi blackish. Wings hyaline, second basal cell united with discal cell; auxiliary and first longitudinal veins united except at their ends, where they terminate separately in the costa; third and fourth veins convergent; halteres light yellow. ♂ differs as follows: Seventh abdominal segment represented by the hypopygium, which is yellowish and bent forward beneath the abdomen. Sixth segment usually more yellowish. Length, both sexes, 7 to 8 mm.; of wing, 4 to fully $4\frac{1}{2}$ mm.; ovipositor of ♀, 2 to $2\frac{1}{2}$ mm. Described from two female and six male specimens. Turkey Tanks, Ariz., July 1, 1892.

LIBRARIAN'S REPORT.

BY B. B. SMYTH, TOPEKA, LIBRARIAN.

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BUENOS AYRES.—*Sociedad Cientifica Argentina:* Anales, Tomo XXXII, 1891, 324 pp., 1 plate; XXXIII, 1892, 252 pp.; La Mineria en la Provincia de Mendoza—El Paramillo de Uspallata, 136 pp., 4 plates, and 1 map.

Florentino Ameghino: Revista Argentina de Historia Natural, Tomo I, 1891, 456 pp.

CORDOBA.—*Academia Nacional de Ciencias en Cordoba:* Boletin, Tomo IX, Entrega 4*a*, 1890, pp. 393–532; Tomo XI, Entrega 4*a*, 1889, pp. 381–624.

LA PLATA.—*Musée de la Plata:* Revista, Tomo I, 1890–'91, 476 pp.; Tomo II, 1891, 472 pp., 6 plates.

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BRÜNN, MORAVIA.—*Naturforschende Vereine in Brünn:* Verhandlungen, XXVIII Band, 1889, 328 pp.; XXIX, 1890, 268 pp., 3 plates.

BUDAPEST, HUNGARY.—*Magyarhoni Földtani Tarsulat—Hungarian Geological Society:* Földtani Közlöny, 18x27 cm., XX Kötet, 1890, 452 pp.; XXI Kötet, 1891, 396 pp.; XXII Kötet, 1892, 1–8 Füzet. [These are beautiful works, printed in both Hungarian and German.]

Kir. Magyar Természettudományi Tarsulat—Royal Hungarian Society of Natural Science: A Magyarországi Myriopodák Magánrajza (Hungarian Myriapods), described by Dr. Eugene Daday. 23x31 cm., 128 pp., 3 plates. [Descriptions are in Latin.]

Adatok a Bor-és Mustelemzés Modszeréhez, by Dr. Richard Ulbricht. 16x22 cm., 120 pp. [Hungarian.]

A Magyar Allattani Irodalom Ismertetése 1881*tol* 1890*ig* Bezárólag, by Dr. Eugene Daday. 18x26 cm., 316 pp. [Hungarian.]

A Magyarországi Tücsöcfélék Természetrajza (Natural History of Gryllidæ in Hungary), by Julius Pungur. 24x32 cm., 96 pp., 6 plates. [Hungarian and French.]

J. S. Von Petényi, der Begründer der Wissenschaftlichen Ornithologie in Ungarn, 1799–1855, by Otto Herman. 26x34 cm., 140 pp. [These are all beautifully-printed works, in roman type, and this last in the German language.]

Ungarische Naturwissenschaftliche Gesellschaft: Mathematische und Naturwissenschaftliche Berichte aus Ungarn, 16x24 cm., Sechster Band, 1887–'88, 506 pp., 4 plates; Siebenter Band, 1888–'89, 530 pp., 4 plates; Achter Band, 1890, 530 pp., 9 plates; Neunter Band, 1891, 480 pp., 3 plates. [Roman type, German language, beautiful print.]

PRAG, BOHEMIA.—*Königl. Böhmische Gesellschaft der Wissenschaften:* Jahresbericht, für 1890, 80 pp.; für 1891, 50 pp.

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VIENNA, AUSTRIA.—*Emil Soeding, Antiquariat:* Catalog 37, Botanik. 60 pp., 1,980 titles.

BELGIUM.

BRUSSELS.—*La Société Royale Linnéenne de Bruxelles:* Bulletin, Tome XVI, 1891; Livraisons 6–12; 17*e* Année, 1891–'92, Nos. 1 to 9, 18x28 cm.

Société Royale de Botanique: Bulletin, Tome Vingt-Neuvième, 1890, embracing Première Partie, Mémoires, 320 pp., 7 plates; and Deuxième Partie, Comptes-Rendus, 250 pp.

Professor Lucien Anspach: L'Ecole Alsacienne—Le Role de l'Eau dans les Cylindres a Vapeur. 124 pp., 1 chart.

P. Wytsman, Libraire: Catalogues, Lepidopteres, etc. 16 pp., 1,000 titles.

LIÉGE.—*La Société Geologique de Belgique:* Annales, Tome XVIII, 140 pp.; Tome XIX, 148 pp.

BRAZIL.

RIO DE JANEIRO.—*Sociedade de Geographia:* Revista, Tomo VI, 1890, Boletim 2°, 48 pp.; Tomo VII, 1891, Boletims 1°, 2°, 3°, 4°, 320 pp.; Tomo VIII, 1892, Boletims 1°–4°, 240 pp. Catalogo da Exposiçao de Geographica Sul-Americana, 476 pp.

CANADA.

CAP ROUGE, QUE.—*M. l'Abbe Provancher:* Le Naturaliste Canadien, monthly, Nov., 1890, to June, 1891. 250 pp., 6 plates.

HALIFAX, N. S.—*Nova Scotia Institute of Natural Science:* Transactions, Vol. VII, Part 4, 1889-'90· 212 pp., 6 maps and plates; Second Series, Vol. I, Part 7, 136 pp., 1 map.

HAMILTON, ONT.—*Hamilton Association:* Journal and Proceedings, No. VII, for 1890-'91, 180 pp., 5 plates; No. VIII, for 1891-'92, 204 pp. [Contains articles geological and historical, of Canada; musical, archæological, and philological, of Ireland and Egypt; biological, palæontological, etc.]

MONTREAL, QUE.—*British Association for the Advancement of Science.*

Royal Society of Canada: Handbook for 1891, 16x12 cm., 140 pp.

Proceedings and Transactions, 23x30 cm., bound, Vol. VIII, for the year 1890, 632 pp., 22 plates and maps; contains the following papers:

Proceedings for 1890, 52 pp.

No. 1. Réalistes et Décadents, par N. Legendre. 12 pp.

No. 2. La Femme dans la société moderne, par N. Legendre. 12 pp.

No. 3. Les points obscurs des voyages de Jacques Cartier, par Paul de Cazes. 10 pp.

No. 4. Nos gros chagrins et nos petites misères, par F. G. Marchand. 4 pp.

No. 5. Les Scandinaves en Amérique, par Alphonse Gagnon. 28 pp.

No. 6. Chez Victor Hugo, par Louis Fréchette, 6 pp.

No. 7. Le premier gouverneur anglais de Quebec, par J. M. LeMoine. 18 pp.

No. 8. La famille de Callières, par Benj. Sulte. 22 pp.

No. 9. Jacques Cartier, par L'abbé Hospice Verreau. 40 pp.

No. 10. Canadian Studies in Comparative Politics, by John George Bourinot. 90 pp.

No. 11. The American Bison, by Chas. Mair. 16 pp.

No. 12. The Vinland of the Northmen, by Sir Danl. Wilson, 18 pp. 1 plate.

No. 13. The Portuguese on the Northeast Coast, by Rev. Geo. Patterson. 46 pp., 8 maps.

No. 14. Unit Measure of Time, by Sandford Fleming. 4 pp.

No. 15. Milk Analysis by the Asbestos Method, by Frank T. Shutt. 4 pp.

No. 16. Drift Rocks of Central Ontario, by A. P. Coleman. 8 pp.

No. 17. Density of Solutions of Certain Sulphates, by J. G. MacGregor. 20 pp.

No. 18. Metallic Iron in Huronian Quartzite, St. Joseph Island, Lake Huron, by G. Chr. Hoffmann. 4 pp., 1 plate, 4 figures, colored.

No. 19. Sun Spots Observed at McGill University, by C. H. MacLeod. 6 pp., 2 cuts.

No. 20. A Method of Measuring Electrical Resistance of Electrolytes, by J. G. MacGregor. 8 pp., 1 cut.

No. 21. Tidal Observations in Canada, by Alex. Johnson. 4 pp.

No. 22. Nephrites from British Columbia, by B. J. Harrington. 6 pp., 1 plate, 4 figures.

No. 23. Physiographical Geology of the Rocky Mountain Region in Canada, by Geo. M. Dawson. 72 pp., 5 maps, 1 cut.

No. 24. Fossil Plants from Similkameen Valley, by Sir J. Wm. Dawson. 18 pp. 32 cuts.

No. 25. New Fossils from Devonian Rocks of Manitoba, by J. F. Whiteaves. 18 pp., 7 plates.

No. 26. Foraminifera and Radiolaria from the Cretaceous of Manitoba, by Jos. B. Tyrrell. 6 pp.

No. 27. A Nova Scotia Carboniferous Conglomerate, by E. Gilpin, jr. 6 pp.

No. 28. Fauna of the St. John Group, by G. F. Matthew. 44 pp., 6 plates and 3 sections.

No. 29. Invertebrates of Acadia, by W. F. Ganong. 18 pp.

Vol. IX, 1891, contains the following papers:

Proceedings, 84 pp.; French Literature, 116 pp.; English Literature, 344 pp., 12 maps and plates; President's Address, Multiplex Telegraphy, Density of Solutions of Nickel Sulphate, Nomenclature in Time Reckoning, Absorption Spectra of Solutions, Symbolic Use of De-Moivre's Function, etc., 64 pp., 1 plate; Fauna of the St. John Group, Trenton Limestone of Manitoba, Geology of Part of the Province of Quebec, etc. 128 pp., 13 plates.

Geological and Natural History Survey of Canada, Alfred R. C. Selwyn, C. M. G., LL. D., F. R. S., Director: Annual Reports, Vol. IV, 1888-'89, 1,090 pp., maps and photographic illustrations, and accompanied by a portfolio of 12 maps of New Brunswick, Mackenzie and Yukon regions. The work contains the following general articles:

1. Operations of the Geological Survey for 1889, by the Director. 66 pp.
2. West Kootanie District, B. C., by Geo. M. Dawson. 66 pp., map and 2 photographic plates.
3. Exploration in Yukon and Mackenzie Basins, N. W. T. 164 pp., 10 maps.
4. Exploration of the Glacial Lake Agassiz in Manitoba, by Warren Upham. 156 pp., 1 map.
5. Mineral Resources of the Province of Quebec, by R. W. Ells. 160 pp.
6. Surface Geology in Southern New Brunswick, by Robt. Chalmers. 92 pp., 3 maps.
7. Chemical Contributions to the Geology of Canada, by G. Chr. Hoffmann. 68 pp.
8. Mining and Mineral Statistics of Canada for 1888, by H. P. Brumell. 96 pp.

9. The same for 1889, by E. D. Ingall and H. P. Brumell. 124 pp.

10. Annotated List of the Minerals Occurring in Canada, by G. Chr. Hoffmann. 68 pp.

Contributions to Canadian Paleontology, Vol. I, Parts II and III, by J. F. Whiteaves, Paleontologist to the Survey, containing:

2. Fossils of Hamilton Formation of Ontario, with list. 36 pp.

3. Fossils of the Triassic Rocks of British Columbia. 24 pp.

4. Cretaceous Fossils from British Columbia, Northwest Territory, and Manitoba. 48 pp., 15 lithograph plates of 134 figures of 71 species.

5. Fossils of the Devonian Rocks of the Mackenzie River Basin. 60 pp., 6 plates of 85 figures of 37 species.

Quarto Memoirs, Vol. III, on Vertebrata from the Tertiary and Cretaceous Rocks of the Northwest Territory, by E. D. Cope.

Part 1. The Species from the Lower Miocene Beds of the Cypress Hills. 28 pp., 14 lithograph plates of many figures.

Contributions to Canadian Micro-Palæontology, Vol. I, Parts 3 and 4, containing:

3. Palæozoic Ostracoda, by T. Rupert Jones. 46 pp., 4 plates of 64 figures, and 6 wood cuts.

4. Radiolaria from Manitoba, by Dr. D. Rüst. 12 pp., 3 plates of 18 figures.

Natural History Society of Montreal: The Canadian Record of Science, Vol. IV, Nos. 6–8, pp. 293–488, with lithograph plates and wood cuts; Vol. V, Nos. 1 and 2, 144 pp. These fasciculi contain, among other articles:

Fossils from the Silurian Rocks of the Saskatchewan; British Wild Flowers; Geology of Quebec; Coleoptera of Canada; A New Horizon in the St. John Group; Granites from British Columbia and Alaska; Flora of St. Helen's Island, Montreal; Flora of Cacouna, P. Q.; Devonian Plants from Scotland; Cherts and Dolomites of Thunder Bay, L. S.; Flora of Cap-a-l'Aigle; Coleoptera of St. Jerome, Quebec; Fossils from the Cambro-Silurian Rocks of Quebec; Laurentian Rocks of the Thousand Isles; Nickel Deposits of Scandinavia; Magnesite from Black Lake, Quebec.

Numismatic and Antiquarian Society of Montreal: The Canadian Antiquarian and Numismatic Journal, Vol. II, No. 4, pp. 147–230, with plates.

OTTAWA.—*Department of Agriculture:* Central Experimental Farm — Bulletin No. 11. Prevention of Damage by Insects to Farm, Orchard, and Garden, by James Fletcher. 22x14 cm., 32 pp.

Report of the Minister of Agriculture for 1891, 44 pp.

Statistical Year-book of Canada, compiled by Sydney C. D. Roper, for 1890, 628 pp.; for 1891, 580 pp.

Ottawa Field Naturalists' Club: Ottawa Naturalist (Transactions), monthly, Vol. III, Nos. 7 to 12; Vol. IV; Vol. V, Nos. 1 to 6.

TORONTO, ONT.—*Canadian Institute:* Annual Reports of the Canadian Institute on the Archæology of Canada, by David Boyle. 26x17 cm., paper. Report for 1887, 58 pp., 117 figures; for 1888, 60 pp., 84 figures; for 1889, 118 pp., 42 figures; Vol. IV, 1890, 90 pp., 162 figures; Vol. V, 1891, 102 pp., 131 figures.

An Appeal to the Canadian Institute on the Rectification of Parliament, by Sandford Fleming. 26x17 cm., 176 pp., small type.

Proceedings of the Canadian Institute, Third Series; Vol. VII, Fasciculi Nos. 1 and 2, 1889–90. 308 pp., containing geological, biological, philological, and ethnological articles of great interest.

Transactions of the Canadian Institute, Vol. I, 1890–'91, 26x17 cm., 300 pp., maps and plates; Vol. II, 1891–'92, same size, 360 pp., maps and plates.

University of Toronto: The Benefactors of the, 18x12 cm., 60 pp.

WINNIPEG, MAN.—*Historical and Scientific Society of Manitoba:* Annual Report for 1890, 8 pp.; Annual Report for 1891, 10 pp. Transactions —

No. 35. Henry's Journal on the Red River Fur Trade, 1799–1801, by Chas. N. Bell, F. R. G. S.

No. 36. Lord Selkirk's Deed from the Hudson's Bay Company, by Jas. Taylor.

No. 37. Henry's Journal, continued.

No. 38. The Riel Rebellion, by Rev. Professor Bryce, LL. D.

No. 39. Land and Sea Birds in the Lower Mackenzie District, by R. R. Macfarlane, Esq., 1890; Annual Report for 1889.

No. 40. 1890–'91. The First Recorder of Rupert's Land, by Geo. Bryce, LL. D., 5 pp.

No. 42. 1891–'92. Older Geology of the Red River and Assiniboine Valleys, by Geo. Bryce, 10 pp.

No. 43. 1892. "Seven Oaks" — Historical of Winnipeg, 40 pp.

CHILE.

SANTIAGO.—*Société Scientifique du Chili:* Actes, 20x26 cm.; Tome II, 1892; Livraisons 1, 2, et 3, 552 pp.

FRANCE.

BORDEAUX.—*Société Linnéenne de Bordeaux:* Procés Verbaux, 17x27 cm., Vol. XLIV, 1890, 72 pp.; XLV, 220 pp.

CAEN.—*L'Académie Nationale des Sciences, Arts et Belles Lettres de Caen:* Mémoires, 1890, 360 pp.; 1891, 324 pp.

La Société Linnéenne de Normandie: Bulletin, Année 1888-'89, 332 pp., 3 plates; 1890, 308 pp., 1 plate; 1891, 332 pp., 4 plates.

CHERBOURG.—*Société Nationale des Sciences Naturelles et Mathematiques de Cherbourg:* Mémoires, Tome XXVII, 408 pp.; XXVIII, 408 pp., 3 plates.

DIJON.—*Académie des Sciences, Arts et Belles Lettres de Dijon:* Mémoires d'Académie de Dijon, Quatrième Serie, Tome II, 1890-'91, 386 pp.; III, 1892, 544 pp.

LE HAVRE.—*Société Havraise d'Etudes Diverses:* Recueil des Publications.

LUXEMBOURG, LUX.—*L'Institut Royal Grand-Ducal de Luxembourg:* Observations Meteorologiques faites a Luxembourg de 1884-'88, Vol. V, 60 pp.; Publications de l'Institut Royal Grand-Ducal—Section des Sciences Naturelles et Mathematiques, Tome XXI, 236 pp., 1 chart.

LYON.—*Société Linnéenne de Lyon:* Annales, Nouvelle Serie, 18x28 cm., Tome XXXV, Année 1888, 348 pp.; XXXVI, An. 1889, 336 pp.; XXXVII, An. 1890, 396 pp.

MARSEILLE.—*Société de Horticulture et de Botanique de Marseille:* Revue Horticole—Journal des Travaux, monthly, Nos. 402, Janvier, 1888, to 458, September, 1892, 16 pp. each.

ORLEANS.—*Société d'Agriculture, Belles Lettres et Arts d'Orleans:* Mémoires, Seconde Serie, Tome XXX, No. 4; XXXI, No. 1.

PARIS.—*Ministère de l'Agriculture:* Bulletin, 18x28 cm., Neuvième Année, No. 4 (1890), pp. 317-440; Dixième Année, No. 1 (1891), 120 pp.

J. B. Baillière & Fils: Catalogue Mensuel de Livres d'Occasion Anciens et Modernes, Nos. 23, 24, 25, 26, 27, 28, 29, 30, 16 to 32 pp., and about 500 titles each.

C. Reinwald & Cie.: Bulletin Mensuel de la Librairie Française, 8 pp. monthly; Catalogue Général, 20 pp., 400 titles.

Librairie Ch. Chadenat: Le Bibliophile Americain—Catalogue des Livres, Cartes, etc., 330 pp., 4,810 titles.

LA ROCHELLE.—*L'Académie de la Rochelle—Société des Sciences Naturelles de Charante Inferieure:* Annales de 1890, No. 27, 160 pp.; 1891, No. 28, 180 pp.

TOULOUSE.—*L'Académie des Sciences, Inscriptions et Belles Lettres de Toulouse:* Mémoires, 16x25 cm., Neuvième Serie, Tome I, 1889, 660 pp.; Tome II, 1890, 612 pp.; III, 1891, 624 pp.

GERMANY.

BERLIN.—*Deutsche geologische Gesellschaft:* Zeitschrift, XLII Band, complete, 1890, 820 pp., 39 plates; XLIII Band, 1891, 1,008 pp., 15 plates; XLIV Band, 1892, Hefts 1 und 2, 384 pp., 20 plates.

Botanischer Verein der Provinz Brandenburg: Verhandlungen, 18x26 cm.; Jahrgang XXXI, 1889, 344 pp., 3 plates; XXXII, 1890, 356 pp., 2 plates.

Entomologischer Verein in Berlin: Berliner Entomologische Zeitschrift, XXXV Band, 1890, 304 pp., 6 plates; XXXVI Band, 1891, 480 pp., 16 plates, and 1 portrait; XXXVII Band, 1892, 248 pp., 6 plates, and 1 portrait.

Mayer & Müller: Bucher Verzeichniss—Katalog No. 95, Botanik. 70 pp., 2,248 titles.

Felix L. Dames: Bibliotheca Zoölogica, No. 17. 56 pp., 1,783 titles.

BONN.—*Naturhistorischer Vereine der preussichen Rheinlande, etc.:* Verhandlungen, Siebenundvierzigster Jahrgang, 1890, 572 pp., 8 plates; XLVIII, 1891, 586 pp., 2 plates, 1 geological map; XLIX, 1892, Erste Halfte, 252 pp., 4 plates.

BREMEN.—*Naturwissenschaftlicher Verein zu Bremen:* Abhandlungen, XI Band (Festschrift), 1889, 472 pp., 20 plates; XII, 1890-'92, 666 pp., 4 plates.

DRESDEN.—*Naturwissenschaftliche Gesellschaft "Isis" in Dresden:* Sitzungsberichte und Abhandlungen, Jahrgang, 1890, 76 pp., 3 plates; 1891, 116 pp., 2 plates; 1892, 124 pp., 4 plates.

FRANKFURT A OBER.—*Naturwissenschaftlicher Verein:* Helios, — pp.; Societatum Litterae, — pp.

GIESSEN.—*Oberhessische Gesellschaft für Natur- und Heilkunde:* Achtundswanzigster Bericht, 1891, 200 pp., 3 plates.

HALLE A SAALE.—*H. W. Schmidt:* Catalog No. 544, Botanik, 40 pp., 1,436 titles; Nos. 547, 549, 554, Historico Naturalis, etc., 3,000 titles.

HAMBURG.—*Naturwissenschaftlicher Verein in Hamburg:* Abhandlungen, 21x26 cm., XI Band, Hefts 2 und 3, 174 pp., 1 plate; XII, Heft 1, 154 pp., 9 plates, new corals.

HANOVER.—*Naturhistorische Gesellschaft zu Hannover:* 41 and 42 Jahresbericht, 1889-'91. 106 pp., 2 plates.

KIEL.—*Naturwissenschaftlicher Verein für Schleswig-Holstein:* Schriften, Band VIII, 1889-'90, 300 pp., 3 plates; IX, 1891-'92, 316 pp., 4 plates.

LEIPZIG.—*Der K. Sachsische Gesellschaft der Wissenschaften zu Leipzig—Mathematisch-Physische Classe:* Berichte uber die Verhandlungen, 1890, 556 pp.; 1891, 700 pp.; 1892, 612 pp.

Oswald Weigel's Antiquarium: Botanischer Katalog No. 53. 102 pp., 780 titles.

K. F. Koehler's Antiquarium: Katalog No. 514, Botanik. 66 pp., 1,790 titles.

MAGDEBURG.—*Naturwissenschaftliche Verein in Magdeburg:* Jahresbericht und Abhandlungen, 1891. 152 pp., 3 charts.

MÜNSTER.—*Westfälischer Provinzial Verein für Wissenschaft und Kunst:* Jahresbericht, Neunzehnter. 1890, 176 pp., 1 chart; Zwanzigster, 1891, 190 pp., 1 plate.

NUREMBERG.—*Naturhistorische Gesellschaft in Nürnberg:* Jahresbericht, VIII, 1889, 276 pp.; IX, 1891, 356 pp., 2 plates, 3 charts.

OFFENBACH.—*Offenbacher Verein für Naturkunde:* Bericht 29, 30, 31, und 32. 1887–'91, 240 pp.

OSNABRÜCK.—*Naturwissenschaftlicher Verein zu Osnabrück:* Jahresbericht, Achter, 1889–'90, 180 pp., 3 plates; Neunter, 1891–'92, 236 pp.

REGENSBURG.—*Naturwissenschaftlicher Verein zu Regensburg:* Berichte, II Heft, für die Jahre 1888–'89, 96 pp., 1 chart, 3 plates; III Heft, 1890–'91, 312 pp.

WIESBADEN.—*Nassauischer Verein für Naturkunde:* Jahrbucher, Jahrgang 42, 1889, 376 pp., 7 plates; 43, 1890, 148 pp., 3 plates; 44, 1891, 308 pp., 1 plate; 45, 1892, 256 pp.

WÜRZBURG.—*Unterfrank. Kreisfischerei-verein Würzburg:* Bericht.

GREAT BRITAIN.

BELFAST, IREL.—*Belfast Natural History and Philosophical Society:* Report and Proceedings for session 1889–'90, 160 pp.; for session 1890–'91, 104 pp.; 1891–'92, 184 pp.

BIRMINGHAM, ENG.—*The Mason Science College:* Calendar, 12x19 cm., bound in white cloth, 1890–'91, 400 pp.; 1891–'92, 426 pp.; 1892–'93, 542 pp.

DUBLIN, IREL.—*Royal Dublin Society:* Scientific Proceedings, Vol. VI (N. S.) contains Remarks on Sagartia venusta and S. nivea; on the Measurement of Small Pressures; on the Control Supply Pipes have on Reeds; on the Arrangement of the Mesenteries in the Genus Sagartia; on the Slates and Clays of Ireland; on Granite and Metamorphic Rocks of Ireland; on Granites of Wicklow and Down; on Direction of Ice Flow in North of Ireland; on Soda Granites and Associated Dykes of Wicklow; on Pallas's Sandgrouse in Ireland; on Geological Unconformabilities; on Physical Questions of Geological Interest—President's Address; on Bunodes thallia, etc.; on Determination of the Absolute Expansion and Densities of Liquids; on Thiokamf; on the Constitution of the Electric Spark; on Texture in Media; on Epidiorites of Ireland; on the Magnetic Moment of Steel; on Natural Science and Ontology; on Lenses for Lighthouse Illumination; on Density of Gases; on Zoölogical Collections in Torres Straits; and other articles. 640 pp., 16 lith. plates.

Vol. VII (N. S.) contains articles on Lepidotera from Murray Island; Land Shells of Torres Straits; A New Reading of the Donegal Rocks; Thermo-Chemistry Studies; Abundance of Life; Tortrix from Tuam; Wet and Dry Methods in Chemical Analysis; Variolite of Ceryg Gwladys; Rhynchota from Murray Island; Method of Preparing Molds (Schizomycetes, etc.) for Museums; West Ireland Fishing Grounds; and other articles. 484 pp., 17 plates, 1 map.

Scientific Transactions, Vol. IV (Series 2), 22x28 cm., Part—

6. On the Fossil Fish of the Cretaceous Formations of Scandinavia, by James W. Davis, pp. 361–434, plates 38 to 46.

7. Survey of Fishing Grounds; West coast of Ireland, 1890. On the Eggs and Larvæ of Teleosteans, by Ernest W. L. Holt, St. Andrew's Marine Laboratory, pp. 435–474, plates 47 to 52.

8. The Construction of Telescopic Object Glasses for the International Photographic Survey of the Heavens, by Sir Howard Grubb, Royal Dublin Society. 4 pp.

9. Lunar Radiant Heat, measured at Birr Castle Observatory, during the total eclipse of January 28, 1888, by Otto Boeddicker, Ph. D., pp. 481–512, plates 53 to 55.

10. The Slugs of Ireland, by R. F. Scharff, Keeper of the Natural History Museum, Dublin, pp. 513–562, plates 56, 57.

11. On the Cause of Double Lines and of Equidistant Satellites in the Spectra of Gases, by George J. Stoney, Royal Dublin Society, pp. 563–608.

12. A Revision of the British Actiniæ. Part II.: The Zoantheæ, by Alfred C. Haddon, Professor Zoölogy, Royal College of Science, Dublin, and Miss Alice M. Shackleton, pp. 609–672, plates 58 to 60.

13. Reports on the Zoölogical Collections Made in Torres Straits, by Prof. A. C. Haddon, 1888–'89: Actiniæ, Part I, Zoantheæ, by Prof. A. C. Haddon and Miss A. M. Shackleton, pp. 673–702, plates 61–64.

EDINBURGH, SCOT.—*Botanical Society of Edinburgh:* Transactions and Proceedings, Vol. XVII, Parts 2 and 3, pp. 149–552, containing: Marine Algæ of Elie, with map (plate 4); Additions to the Scottish Flora; Doctor Trail, on the Galls of Norway; Flora of West Sutherland; Annual Increase in Girth of Trees; Coloring Matters of Leaves and Flowers; Plants in the Royal Botanic Garden; Wood of Resin-Producing Trees; Botanical Features of the Country Traversed by Afghan Commission; Aitchison, on the Source of Badsha Salep; Flora of Siberian and Lapland Coasts; Fungi of Hardanger; and other articles.

Vol. XVIII, 510 pp., 6 plates, containing: Aitchison, on Products of Western Afghanistan and Northeastern Persia, 228 pp.; Remarks on Genus Nepenthes (President's address); Cape Flora—Regional Distribution; Material Required for a Botanical Expedition; Traill, on the Marine Algæ of the Dunbar Coast and Orkney Islands, 70 pp.; Germination and Growth of Species of Salvia; Mann, on Studies of Chlorophyll and Spirogyra; Rings in Trees and Tree Measurements; and other articles.

Vol. XIX, pp. 1-232, 3 plates, contains articles on Excursion to Connemara of the Scottish Alpine Botanical Club; Girth Increase in Trees; Embryo Sac of Angiosperms; Vegetation of British Guiana; Larrea mexicana Moric.; Roots of Grasses in Relation to their Upper Growth, illustrated; and other articles.

GLASGOW, SCOT.—*The Geological Society of Glasgow:* Vol. VIII, 1884-'88, 392 pp., 6 plates, contains articles and notes on Cone-in-Cone Structure; Upper Limestones of North Ayrshire, with list of fossils; Parallel Roads of Lochaber; Geology of Oban; Geology of Idaho; Post-Pliocene Beds of Irvine Valley; Glacial Phenomena of Scotland; Sir Wm. Thomson, on Polar Ice Caps, illustrated; and other articles.

Vol. IX, Part 1, 1888-'90, 240 pp., 10 plates, contains articles on Fructification and Internal Structure of Carboniferous Ferns; Internal Structure of Carboniferous Corals; Geology of the Lugton Valley; Phenomena of the Glacial Epoch—"The Great Submergence"; Surface Geology of Paisley; The Great Ice Age in the Garnock Valley; Finds in an Ancient Lake in Cowdenglen, Renfrewshire; and other articles.

The Philosophical Society of Glasgow: Proceedings, XXI, 1889-'90, 296 pp., 5 plates; cyanotype reproduction of seaweed, and two maps; contains articles on Sanitation; Electrification of Air by Combustion; Studies of Comets; Basidity of Acids; Territorial Expansion of the British Empire during the Last Ten Years; Public Lighting by Electricity; Club-mosses, Past and Present; Electrical Oscillations, etc.

Vol. XXII, 1890-'91, 384 pp., 3 plates, contains Problems of Modern Physiology; Gravimetric Composition of Water; Oyster Fishery of Scotland; Max Müller on Language; Sociological Notes on Iceland; Physiological Action of Carbon Monoxide of Nickel; Progress of Sanitation; Anglo-Saxon Poem of Béowulf; The Great Winter—A Chapter in Geology; Chemistry of Democritus and Synesius; and other articles.

Vol. XXIII, 1891-'92, 372 pp., 6 plates, contains articles on Limes and Cements; The Sewage Problem; Women's Wages; School Building in Glasgow; Origin of the Faust Legend; Telephone Switch-boards; Warming and Ventilation; Manufacture of Oxygen; Consumption, etc.—their Spread; Fogs; and other articles.

LIVERPOOL, ENG.—*Liverpool Geological Society:* Proceedings, Vol. VI, pp. 341-460, contains articles on The Earth in its Cosmical Relations; Glacial Deposits near Liverpool; The Trias of Cannock Chase, with cuts; and other articles.

LONDON, ENG.—*Royal Botanical Society of London:* Quarterly Record, 1880 to 1891, 4 volumes, bound; about 200 pp. each; Vol. V, Nos. 50, 51, April to September, 1892, pp. 17-64.

Geologists' Association.

The Geological Society of London: Abstract of the Proceedings, session 1890-'91, Nos. 561-577, 116 pp.; session 1891-'92, Nos. 578-594, 120 pp.; List of the Society, November 2, 1891, 80 pp.

Dulau & Co.: Catalogues of Scientific Works, all languages, all sciences, each separate, 12x18 cm. 1,200 pp. or over, some 18,000 titles.

Geo. Harding: Bibliotheca Œconomica. 24 pp., 730 titles.

W. P. Collins: Scientific Book Catalogue, No. 27. 20 pp., 500 titles.

Wm. Wesley & Son: Natural History and Scientific Book Circular, Nos. 110-117, Geology, Mineralogy, Crystallography, Petrography, Astronomy, Meteorology, Physical Geography, Electricity, Mammals, Ornithology, Reptilia, etc. 448 pp., 12,000 titles. Bibliotheca Botanica, 200 pp., bound in cloth, 3,500 titles.

MANCHESTER, ENG.—*Manchester Literary and Philosophical Society:* Memoirs and Proceedings, Fourth Series, Vol. III, 1890, 348 pp., 10 colored plates, contains articles on Croll's Theory of Glacial and Warm Periods; Combination of Hydrogen and Chlorine; Bibliography of Viscosity; The Author of the Glacial Theory; Sphenophyllum as a branch of Asterophyllites; Absorption Spectra, and a Method for their Determination; Hymenoptera Orientalis, II; and other articles.

Vol. IV, 1890-'91, 516 pp., 4 plates, the last one a colored geological chart of Levenshulme limestones, 23 dm. in length. The volume contains articles on Thermal Conductivities; Specific Heat of Nonconductors; The Theory of Glacier Motion; Intensity of Transmitted Light; Credit Money and the Precious Metals; The Levenshulme Limestones; Genus Latirus; Hymenoptera Orientalis, III; etc.

Vol. V, 1891-'92, 216 pp., 4 plates, contains experiments on Transmission of Explosions; Functions Formed on Groups; The Permians of Northwest England; Hymenoptera Orientalis, IV; Iridescent Colors; Action of Acetic Acid on Indigo Blue; and other articles.

Vol. VI, James Prescott Joule: A Memoir, by Osborne Reynolds, M. A., LL. D., etc., Professor of Engineering, Owen College, Manchester. 196 pp., with steel-plate frontispiece.

PENZANCE, ENG.—*Royal Geological Society of Cornwall.*

ITALY.

BOLOGNA.—*R. Accademia delle Scienze dell' Istituto di Bologna:* Memorie delle Scienze Naturali, 23x30 cm., Serie IV, Vol. IX, 1890, 348 pp., 28 plates; Serie V, Vol. I, 1891, 280 pp., 20 plates. Del Meridiano Iniziale e dell' Ora Universale, 10 pp.

CATANIA.—*Accademia Gioenia di Scienze Naturali in Catania:* Bulletino Mensile, Nuova Serie, Fascicolo XIV-XXV, Aprile, 1890—Marzo, 1892, 150 pp. Atti, 21x30 cm., Serie IV, Vol. I, 1888-'89, 332 pp., 10 plates, 2 maps; Vol. II, 1889-'90, 292 pp., 12 plates; Vol. III, 1890-'91, 360 pp , 4 plates.

NAPLES.—*Societa Americana d' Italia:* Programma e Statuto, 24 pp.

Ferdinando Borsari: Etnologia Italica—Etruschi, Sardi e Siculi nel XIV° Secolo Prima dell' Era Volgare, 20 pp. Biblioteca Etiopica, 96 pp., 1 map.

PADUA.—*R. Accademia di Scienze, Lettere ed Arti in Padova:* Atti e Memorie, Nuova Serie, Vol. VI, 284 pp., I plate.

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Coleopteros Indigenas, por Sr. Dr. D. Eugenio Dugès. 38 pp., 2 plates of 64 colored figures.

El Clima del Valle de Mexico y la Biologia de los Vertebrados, por Sr. Prof. Alfonso L. Herrero, 48 pp.

Apuntas para la Geologia del Valle de Mexico, por Sr. Ing. D. Guillermo B. y Puga, 10 pp., map and illustrations.

Natural history articles, by Dr. Alfredo Dugès.

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No. 3. Til kundskab om vor yngre jernalder, by Dr. Ingvald Undset. 16 pp., 3 litho. plates.

No. 4. Om 6 for Norges Fauna nye Fugle, fundne i 1887-'89, by Robert Collett. 20 pp.

No. 5. Om en ægyptisk Mumie, by J. Lieblein. 18 pp.

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No. 7. Geologiske iagttagelser fra Trondhjems stift, by Hans Reusch. 60 pp.

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Hagen, 56 pp.; Flora Lapponica, 13 pp.; Biskop Gunnerus's virksomhed—Early history of botany in Denmark and Norway, before 1750, 160 pp.

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Förhandlingar, Vol. XXXI, 1888–'89, 280 pp., 5 litho. plates and charts; XXXII, 1889–'90, 276 pp., 1 plate; XXXIII, 1890–'91, 336 pp., 1 plate.

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Mémoires du Comité Géologique, 25x32 cm., Vol. IV, No. 2, Allgemeine Geologische Karte von Russland, Blatt 138, von A. Saytseff. 116 pp.

Vol. V, No. 1, Carte Géologique Générale de la Russie, Feuille 57, par S. Nikitin. 312 pp., 1 chart, 65x95 cm.

Vol. V, No. 5, Dépôts Carbonifères et Puits Artesiens, par S. Nikitin. 192 pp., 3 litho. paleont. plates.

Vol. VIII, No. 2, Die Ammoniten der Unteren Volga-Stufe, von A. Michalski. 360 pp., 12 litho. paleont. plates.

Vol. X., No. 1, Le Tremblement de Terre de Verny (June 9, 1887), J. V. Muschketoff. 158 pp., 3 geological charts, 42 illustrations.

Vol. XI, No. 1, General Geological Chart of Russia, Part 126, Perm, Solikamsk, by A. Krasnopolsky. 536 pp., 2 plates, 1 chart, 65x95 cm.

Vol. XI, No. 2, The same title; explanatory notes in French, 30 pp.

Vol. XIII, No. 1, Geologische Untersuchungen—Central-Ural, von A. Saytzeff. 104 pp.

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MADRID.—*Real Academia de Ciencias Exactas, Fisicas y Naturales:* Memorias, 20x30 cm., Tomo XV. Estudios Preliminares sobre los Moluscos Terrestres y Marinos de España, Portugal y las Baleares. 740 pp.

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AKRON, OHIO.—*E. W. Claypole:* Discovery of Pteraspidian Fish in Upper Silurian Rocks in N. A., 18 pp.: Structure of the American Pteraspidian Palæaspis (Claypole), with remarks, 22 pp.: The Head of Dinichthys, 10 pp., 1 pl.; Vertical Range of Certain Fossil Species in Pennsylvania and New York, 10 pp.; The Continents and Deep Seas, 8 pp.; The Perry County (Pennsylvania) Fault, 24 pp., 1 pl.; Organic Variation Indefinite, 24 pp.

ALBION, N. Y.—*Frank H. Lattin, Publisher:* The Oölogist, monthly, occasional and irregular. Vol. VII, No. 12; VIII, 1, 3-6, 8, and 11; and IX, 1, 4 and 5 are received, about 16 pp. each.

AMES, IOWA.—*Iowa Academy of Science:* See Des Moines.

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L. H. Pammel: Report of the Department of Botany, from Biennial Report Iowa State Agricultural College, 8 pp.

On Pollination of Phlomis tuberosa L., and the Perforation of Flowers, from Transactions St. Louis Academy of Science, 48 pp., 2 pl.

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Fungous Diseases of the Sugar Beet, from Bulletin Iowa Agricultural Experiment Station, 16 pp., 6 pl.

ANN ARBOR. MICH.—*University of Michigan:* Librarian's Report for 1890, 8 pp.: President's Report for 1890, 40 pp.

ATCHISON, KANS.—*Board of Education:* Manual of the Public Schools, 1890, 156 pp.

AUSTIN, TEX.—*Alex. Macfarlane:* Fundamental Theorems of Analysis Generalized for Space, 32 pp.

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BALDWINSVILLE, N. Y.—*W. M. Beauchamp:* Land and Fresh-Water Shells of Onondaga County, 12 pp.; Iroquois Notes, 8 pp.; Rhymes from Old Powder-Horns, 8 pp.

BALTIMORE. MD.—*Johns Hopkins University:* Circulars, 24x30 cm., Nos. 83-100, Vol. X, 150 pp.; XI, 136 pp. Fifteenth Annual Report, 1890, 92 pp. Register for 1890-'91, 154 pp.

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J. Walter Fewkes: New Invertebrata from the Coast of California, 50 pp., 16 pl.; On Excavations made in Rocks by Sea Urchins, 22 pp.; On a few Californian Medusæ, 12 pp., 7 pl.

Marine Biological Laboratory: Fourth Annual Report, for 1891, 40 pp.

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BRIDGEPORT, CONN.—*Bridgeport Scientific Society:* List of Birds Found in the Vicinity of Bridgeport, Conn., by C. K. Averill, jr., 20 pp., 246 numbers.

BROOKVILLE, IND.—*Amos W. Butler:* Our Smaller Mammals and their Relation to Horticulture, 8 pp.; The Habits of some Arvicolinæ, 4 pp.; Observations on the Muskrat, 12 pp.; Contributions to Indiana Herpetology, No. 3, Urodela—the Salamanders, 8 pp.; The Birds of Indiana, with illustrations, 136 pp.

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Herbert L. Jones, 23 College House: Catalogue of the Phanerogams and Ferns of Licking County, Ohio—Bulletin of the Scientific Laboratories of Denison University, Vol. XII, 104 pp. with map.

Museum of Comparative Zoölogy at Harvard College: Annual Reports of the Curator, for 1889-'90, 32 pp., 1 pl.; for 1890-'91, 32 pp.; for 1891-'92, 40 pp., 6 pl.

Bulletin, Vol. XVI, No. 10. Metamorphism of Clastic Feldspar in Conglomerate Schist, by J. E. Wolff. 12 pp., 4 pl.

No. 11. The Conditions of Erosion beneath Deep Glaciers, based upon a study of the Boulder train from Iron Hill, Cumberland, R. I., by N. S. Shaler. 44 pp., 4 pl., and 1 map.

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No. 2. The Mesoderm in Teleosts, by E. R. Boyer. 48 pp., 8 pl.

No. 3. On Nectonema agile Verrill, by Henry B. Ward. 60 pp., 8 pl.

CHAMPAIGN, ILL.—*Illinois State Laboratory of Natural History:* Bulletins, Vol. II, Art. I. Descriptive Catalog of the North American Hepaticæ North of Mexico, by Lucien M. Underwood, Ph. D. 136 pp.

Art. II. Description of New Illinois Fishes, by S. A. Forbes. 4 pp.

Art. III. Parasitic Fungi of Illinois, Part 1, Uredineæ, by T. J. Burrill. 120 pp.

Art. IV. Studies on the Contagious Diseases of Insects, by S. A. Forbes. 68 pp., 1 helio. pl.

Articles 5 to 8 of Vol. II, and 1 to 4 of Vol. III, previously acknowledged (Vol. XI).

Vol. III, Art. V. A Descriptive Catalogue of the Phalangiinæ of Illinois, by Clarence M. Weed, M. Sc. 20 pp.

Art. VI. A Partial Bibliography of the Phalangiinæ of North America, by Clarence M. Weed, M. Sc. 8 pp.

Art. VII. On an American Earthworm of the Family Phreoryctidæ, by S. A. Forbes. 12 pp., 3 pl.

Art. VIII. An American Terrestrial Leech, by S. A. Forbes. 4 pp.

Art. IX. A Preliminary Report on the Animals of the Mississippi Bottoms, near Quincy, Ill., in August, 1888, Part 1, by H. Garman. 64 pp.

Art. X. Notes on Illinois Reptiles and Amphibians, including several species not before recorded from the Northern States, by H. Garman. 6 pp.

Art. XI. Descriptions of New Cynipidæ in the Collection of the Illinois State Laboratory of Natural History, by C. P. Gillette. 16 pp., 1 pl.

Art. XII. Sixth Contribution to a Knowledge of the Life History of Certain Little-known Aphididæ, by Clarence M. Weed. (The Corn-Root Aphis—*Aphis maidis* Fitch.) 8 pp.

Art. XIII. A Synopsis of the Reptiles and Amphibians of Illinois, by H. Garman. 176 pp., 7 pl.

Vol. IV, Art. I. Bacteria Normal to Digestive Organs of Hemiptera, by S. A. Forbes. 6 pp.

Biennial Report of the Director of the Illinois State Laboratory of Natural History, 1891-'92. 8 pp.

CHAPEL HILL, N. C. *Elisha Mitchell Scientific Society:* Journal, for the year 1883-'84, 96 pp.; for the year 1885-'86, 118 pp., litho. plate of Lewis David Von Schweinitz, and 1 map; fourth year, 1887, Parts I and II, 181 pp., 9 pl., including a phototype of Washington Caruthers Kerr; fifth year, 1888, Parts I and II, 148 pp.; sixth year, 1889, Parts I and II, 164 pp., 10 pl.; seventh year, 1890, 132 pp., 3 pl.; eighth year, 1891, 132 pp., 3 pl.; ninth year, 1892, Part I, 50 pp.

CHARLESTOWN, W. VA.—See Morgantown, W. Va.

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University of Chicago.

CINCINNATI, O.—*Historical and Philosophical Society of Ohio:* Annual Report, for the year ending December 1, 1890, 16 pp.

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CRETE, NEB.—*Goodwin D. Swezey:* Doane College Natural History Studies, No. 1, Nebraska Flowering Plants, 16 pp.

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DES MOINES, IOWA.—*Iowa Academy of Sciences:* Proceedings, Vol. I, Part 1, 1887-'89, 100 pp., contains the following papers, or abstracts of them: The Terraces of the Missouri, and Origin of the Extra-Morainic Till, by J. E. Todd; Catalogue of the Mammals of Iowa, by Herbert Osborn; The Parvus Group of Unionidæ, by R. Ellsworth Call; The Lineage of Lake Agassiz and Folding of Carboniferous Strata in Southwestern Iowa, by J. E. Todd; The Native Food Fishes of Iowa, by Seth E. Meek; Fossils of the Keokuk Beds, by C. H. Gordon.

Vol. I, Part 2, 1890-'91, 136 pp., 1 map, contains: Geology of Northwestern Iowa, Shore Lines of Ancient Glacial Lakes, and Striation of Rocks by River Ice, by J. E. Todd; Geological Notes, by Chas. R. Keyes; The Fishes of the Des Moines Basin, by R. Ellsworth Call; Artesian Wells in Iowa, with map, by the same; Forest Vegetation of the Upper Mississippi, Report of the Committee on State Flora, and Fungous Diseases of Iowa Forage Plants, The Gall-Producing Cynipidæ of Iowa, and other articles, by C. P. Gillette; Catalogue of the Hemiptera, and Orthopterous Fauna of Iowa, by Herbert Osborn.

Vol. I, Part 3, 1892, 116 pp., contains: The Cretaceous Deposits of Iowa, by S. Calvin; Mineralogical and Geological Notes, by Chas. R. Keyes; President's Address, Report of Committee on State Fauna, etc., by C. C. Nutting; Phænological Notes, etc., by L. H. Pammel; A Key for the Identification of Weed Seeds found in Clover Seed, by F. C. Stewart; The Fishes of the Cedar River Basin, by Seth E. Meek.

DENVER, COLO.—*Colorado Scientific Society:* Vol. III, 504 pp., 4 plates and sketch maps; contains, among others, the following papers: Colorado Volcanic Craters, by P. H. Van Diest; The Quaternary of the Denver Basin, by Geo. L. Cannon, jr.; Mineralogical Notes, by W. F. Hillebrand; Stratigraphical and Structural Features of the Country about Denver, by George H. Eldridge; The Denver Tertiary Formation, by Whitman Cross; Tertiary Dinosauria in Denver Beds; Tertiary Beds of the Huerfano River Basin (with map), by R. C. Hills; Eruptive Rocks of Boulder and Adjoining Counties, by Chas. S. Palmer; Gold Deposits in the Quartzite of Battle Mountain, by F. Guiterman; Geology of the Rosita Hills, Custer County, by Whitman Cross; Orographic and Structural Features of Rocky Mountain Geology, by R. C. Hills.

On the Ore Deposits of Newman Hill, near Rico, Colo., by John B. Farish. 16 pp. and a sketch map 66x66 cm.

Report on the Technical Determination of Zinc, by a committee of five. 20 pp.

The Nature of the Chemical Elements, by Charles Skeele Palmer. 10 pp.

The Post Laramie Beds of Middle Park, Colo., by Whitman Cross. 28 pp.

DETROIT, MICH.—*Frederick Stearns:* A List of Mollusca Collected in Japan in 1889-'90, by Frederick Stearns. 24 pp. with 1 pl. List of Echinoderms and Crustaceans in the cabinet of Frederick Stearns, together with Echinoderms and Arthropods from Japan, by J. E. Ives; Echinoderms from the Bahama Islands, by J. E. Ives, 6 pp., 1 pl. List of the Asteroidea, Ophiuroidea, Echinoidea, and Crustacea, at present in the private collection of Frederick Stearns, 16 pp., 6 pl. Handsome Sea Shells, for Ornamental Use on Mantel, Brackets, or in Cabinet, priced, 2 pp.

ELMIRA, N. Y.—*Elmira Academy of Sciences:* Proceedings, Vol. I, No. 1, June, 1891, 70 pp., contains, among other articles, the following: Historical Sketch of the Academy; Catalogue of the Birds of Chemung County, by Dr. Wm. H. Gregg; Description of Capromys ingrahami, by J. A. Allen; A New Electric Chronograph, by D. R. Ford; Where to Find Living Objects for Examination by Microscope, by Anna M. Stuart; The Tioga River and its Tributaries, in connection with the great flood of June 1, 1889, by Robert A. Hall; The Chemung County Flora, by Dr. F. F. Lucy.

EMPORIA, KANS.—*Rev. James W. Hanna:* Theoretical Astronomy from a New Base, 56 pp., with figures.
State Normal School: Annual Catalogue, 1890-'91, 84 pp.

GENEVA, N. Y.—*New York Agricultural Experiment Station:* Bulletin No. 33, new series, on Fertilizers, 24 pp.; Potash and Paying Crops, 48 pp.; No. 34, Comparison of Dairy Breeds of Cattle, with refence to production of butter, 48 pp.; No. 35, Some of the Most Common Fungi and Insects, with Preventives, 28 pp.; No. 36, Small Fruits—their Diseases, and Insect Enemies, 20 pp., largely of the same matter as No. 35.

GRANVILLE, O.—*Denison University:* Bulletin—see Cambridge, Mass.—Herbert L. Jones.

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HYDE PARK, MASS.—*Frank Blake Webster Company:* Ornithologist and Oölogist, Vol. XV, Nos. 10-12, pp. 145-188; Vol. XVI, 1891, 184 pp.; Vol. XVII, 1892, Nos. 1-9, pp. 1-144.

INDIANAPOLIS, IND.—*Department of Geology and Natural History.*
Indiana Academy of Science—see Brookville, Ind.

IOWA CITY, IOWA.—*Iowa Academy of Science*—see Des Moines.

State Historical Society: Iowa Historical Record, quarterly, Vol. VII, Nos. 1 to 4, 1891, 192 pp., steel and other engravings of Wm. Patterson, Austin Adams, Chas. B. Richards, and Ralph P. Lowe.

Vol. VIII, Nos. 1 to 4, 1892, 192 pp., with portraits of Elias H. Williams, James M. Love, Dr. Enos Lowe, and James W. Grimes.

State University of Iowa: Bulletin from the Laboratories of Natural History, Vol. II, No. 2, 100 pp., 13 pl., containing: 1. The Myxomycetes of Eastern Iowa, by Thos. H. McBride. 2. Report on some Fossils collected in the Northwest Territory, Canada, by Naturalists from the University of Iowa, by S. Calvin. 3. Two Unique Spirifers from the Devonian Strata of Iowa, by S. Calvin. 5. Pyrgulopsis scalariformis, by B. Shimek. 6. A Geological Reconnoissance in Buchanan County, Iowa, by S. Calvin.

JEFFERSON CITY, MO.—*Arthur Winslow, State Geologist:* Biennial Report of the State Geologist, 1891, 56 pp., 2 diagram maps.

Notes on the Mining of Thin Coal Seams in Missouri and Kansas, by Arthur Winslow and Leo Gluck, assistant. 14 pp.

Coal Mining in the Belleville Seam, and a Comparison of the "Needle" and "Barrel" Methods of Blasting, by Leo Gluck. 8 pp.

F. A. Sampson, Sedalia—see Sedalia.

KANSAS CITY, MO.—*Kansas City Academy of Science:* The Kansas City Scientist, Vol. V, 1891, in monthly parts, 192 pp., 4 pl., consisting of: 1, Trilobites of the Upper Coal-Measure Group at Kansas City, Mo., by Sid. J. Hare; 2 and 3, Some New Species of Echinodermata from the Subcarboniferous Rocks of Pike County, Mo., by R. R. Rowley and Sid. J. Hare; and 4, The Exeter Vase, an "ancient" vase with carvings, said to have been excavated near Exeter, Barry county, Mo., in a cut of the St. Louis & San Francisco railway.

KNOXVILLE, TENN.—*F. Lamson-Scribner:* The Grasses of Tennessee, Part I, 120 pp., numerous illustrations, flexible cover.

LANCASTER, PA.—*John K. Small:* Preliminary List of Mosses of Lancaster County, Pa., February, 1892, 8 pp.

LANSING, MICH.—*Michigan Agricultural College:* Michigan Flora, by W. J. Beal and C. F. Wheeler, 1892, 180 pp., 1 two-page map.

LAWRENCE, KANS.—*Kansas State University:* Higher Education: Its Aims and its Results, an address by Geo. R. Peck. 20 pp.

The Best Books, an address by Daniel W. Wilder. 20 pp.

The Kansas University Quarterly, Vol. I, Nos. 1 and 2, 100 pp., 8 pl. and map, containing articles on Kansas Pterodactyls, by S. W. Williston; Kansas Mosasaurs, by S. W. Williston and E. C. Case; Notes and Descriptions of Syrphidæ, by W. A. Snow; Melitera dentata Grote, by V. L. Kellogg; Diptera Braziliana, by S. W. Williston; Unicursal Curves by Method of Inversion, by H. B. Newson; Foreign Settlement in Kansas, and Dialect Word List, by W. H. Carruth; The Great Spirit Spring Mound, by E. H. S. Bailey; Pascal's Limaçon and the Cardioid, by H. C. Riggs.

Vernon L. Kellogg: Common Injurious Insects of Kansas, 136 pp., numerous illustrations.

LINCOLN, NEB.—*University of Nebraska:* University Studies, Vol. I, No. 4, June, 1892, contains articles On a New Order of Gigantic Fossils—"Devil's Corkscrew," by Erwin H. Barbour, 24 pp., 8 pl., and numerous figures; On Certain Facts and Principles in the Development of Form in Literature, by L. A. Sherman, 30 pp., with diagrams; On the Dikanikos Lógos in Euripides, by James T. Lees, 12 pp.

LITTLE ROCK, ARK.—*Arkansas Geological Survey*—see Palo Alto, Cal., Dr. J. C. Branner, and Washington, D. C., F. V. Coville.

MADISON, WIS.—*J. B. Thayer, State Supt:* Circular on the Free High Schools of Wisconsin, with comments on the high-school law, 1890, 24 pp.

Rollin D. Salisbury: The Drift of the North German Lowland. From the American Geologist, May, 1892, 28 pp.

Wisconsin Academy of Sciences, Arts, and Letters: Transactions, Vol. VIII, 1888-'91, 476 pp., 8 plates, and two portraits of former presidents, Roland Duer Irving and Wm. Francis Allen. Contains, among other articles, Analytic Keys to the Genera and Species of Mosses, by Charles R. Barnes; The First Abdominal Segment of Embryo Insects, by W. M. Wheeler; A Little-known Region in Northwestern Montana, with map, by G. E. Culver; Occurrence of Olivine Diabase in

Minnehaha County, S. D., by G. E. Culver and Wm. H. Hobbs; The Iron Ores of the Lake Superior Region, by C. R. Van Hise; The Correlation of Moraines with Raised Beaches of Lake Erie, by Frank Leverett; The Effects of Changes in Temperature on the Distribution of Magnetism, by Hiram B. Loomis; The Limonene Group of Terpenes, by Edward Kremers; List of Crustacea Cladocera from Madison, Wis., by E. A. Birge.

MANHATTAN, KANS.—*A. S. Hitchcock:* Key to Kansas Trees in their Winter Condition. 6 pp., 1 pl.

Kansas State Agricultural College—Experiment Station: Third Annual Report, 1890, 16 pp.; Fourth Annual Report, 1891, 24 pp.

Bulletins: No. 14. Winter Protection of Peach Trees, and Notes on Grapes. 12 pp.
No. 15. Experiments and Observations on Oat Smut, made in 1890. 40 pp., 1 pl.
No. 16. Experiments with Sorghum and with Sugar Beets. 16 pp.
No. 17. Crossed Varieties of Corn, Second and Third Years. 20 pp., 1 pl.
No. 18. Experiments with Forage Plants. 18 pp.
No. 20. Experiments with Wheat. 46 pp.
No. 21. Report on Fungicides for Stinking Smut of Wheat. 28 pp., 1 pl.
No. 22. Same subject. 20 pp.
No. 25. Experiments with Sorghum. 12 pp.
No. 26. Comparison of Varieties of the Strawberry. 12 pp.
No. 27. Crossed Varieties of Corn, Third Year. 20 pp.
No. 28. Report on Vineyard. 12 pp.
No. 30. Experiments with Corn. 28 pp.
No. 31. Sugar Beets. 20 pp.
No. 32. Tests of some Japanese Beans, etc. 16 pp.
No. 33. Experiments with Wheat. 50 pp.
No. 34. Experiments in Feeding Steers. 48 pp., 8 pl.

MERIDEN, CONN.—*Meriden Scientific Association:* Transactions, Vol. IV, 1889-'90. 90 pp.

MILWAUKEE, WIS.—*Public Museum:* Tenth Annual Report of the Board of Trustees, October 1, 1892. 74 pp.

MINNEAPOLIS AND ST. PAUL, MINN.—*Geological and Natural History Survey of Minnesota, N. H. Winchell, State Geologist:* Sixteenth Annual Report, for 1887. 504 pp., 2 pl., and 83 other illustrations. Contains reports on the original Huronian area, the Marquette iron region, on the Gogebic and Penokee iron-bearing rocks, on the formations of northeastern Minnesota (including the physical aspects, vegetation, quadrupeds and other vertebrates), the geology of the region northwest from Vermilion lake to Rainy lake, and of the Little and Big Fork rivers, by N. H., Alexander, and H. V. Winchell; also notes on the molluscan fauna of Minnesota, by Uly. S. Grant and John M. Holzinger.

Seventeenth Annual Report, for 1888. 280 pp., 10 text illustrations. Contains report of N. H. Winchell, the crystalline rocks of Minnesota, a general report of progress made in the study of their field relations, with a bibliography of recent works on the crystalline rocks; report of H. V. Winchell, field observations in the iron regions; report of Uly. S. Grant, geological observations in northeastern Minnesota.

Eighteenth Annual Report, for 1889. 234 pp., bound in cloth. Report of further field observations in the regions of the crystalline rocks of the state and in the area of the original Huronian, by N. H. Winchell, and a review of American opinion on the older rocks, by Alexander Winchell.

Nineteenth Annual Report, for 1890. 256 pp., 2 pl., and 32 illustrations. Translation of Boricky's elements of a new chemico-microscopic method of analysis of rocks and minerals, and of Kloos' geognostic and geographical observations in Minnesota in 1877, by N. H. Winchell; chemical report, by Professor Dodge; the woods of Minnesota, by H. B. Ayres; museum and library additions, list of meteorites in the museum, petrography and geology of the Akeley lake region, by W. S. Bayley; New Lower Silurian Lamellibranchiata, by E. O. Ulrich.

Twentieth Annual Report, for 1891. 350 pp., 12 pl., and other illustrations. Contains some preliminary considerations as to the structure and origin of the crystalline rocks, the philosophy of dynamic metamorphism, and the anomalous character of the greenstones and schists, by N. H. Winchell; field observations on certain granite areas—Kawishiwi, Snowbank lake, Kekequabic and Saganaga lake areas, by U. S. Grant; the Mesabi iron range, by Horace V. Winchell; the Coastal Topography of Lake Superior, with special reference to the abandoned strands of Lake Warren, by A. C. Lawson; Diatomaceæ of Minnesota Interglacial Peat, by B. W. Thomas and Hamilton L. Smith; Oxide of Manganese, by N. H. Winchell.

Bulletin No. 1, History of Geological Surveys in Minnesota, by N. H. Winchell, 1889. 40 pp.

No. 6. The Iron Ores of Minnesota: Their geology, discovery, development, qualities, and origin, and comparison with other iron districts, by N. H. and H. V. Winchell, 1891. 440 pp., bound in cloth, with 44 pl., 26 figures, and one geological map, 84x116 cm., in pocket.

No. 7. The Mammals of Minnesota: A scientific and popular account of their features and habits, by C. L. Herrick, 1892. 300 pp., bound in cloth, with 8 pl. (one—Geomys bursarius—colored), and 23 figures of mammals.

MONTGOMERY, ALA.—*Geological Survey of Alabama, Eugene A. Smith, State Geologist:* Bulletin No. 1. Report on the Coal Measures of the Plateau Region of Alabama, by Henry McCalley and a Report on the Coal Measures of Blount County, by A. M. Gibson. 1891, 240 pp., with a map of the coal fields and two geological sections 90 cm. in length across the plateau region and intermediate valleys.

No. 2. On the Phosphates and Marls of Alabama, by E. A. Smith. 1892, 82 pp.

No. 3. A Preliminary Report on a Part of the Lower Gold Belt of Alabama, by Wm. B. Phillips, Ph. D. 1892, 100 pp., with map and 4 pl.

No. 4. Report on the Geology of Northeastern Alabama, and Adjacent Portions of Georgia and Tennessee, by C. Willard Hayes, U. S. Geol. Survey. 1892, 84 pp., with map 40x50 cm. and geological section.

MORGANTOWN, W. V.—*West Virginia Agricultural College Experiment Station:* Bulletins.

MOUNT CARMEL, ILL.—Dr. Jacob Schneck: The Rappites: A History of New Harmony, Ind., by Dr. J. Schneck and Col. Richard Owen. 20 pp.

NASHVILLE, TENN.—*State Board of Health:* Bulletin, monthly, Vol. VI, Nos. 4 to 12, pp. 49 to 196; Vol. VII, complete, 176 pp.; Vol. VIII, Nos. 1 to 3, pp. 1 to 64.

Vanderbilt University: Register, 1890–'91, and Announcement, 1891–'92. 184 pp., 1 pl.

NEW BRIGHTON, N. Y.—*Natural Science Association of Staten Island:* Proceedings, Vol. 1, 1883–'88, 92 pp.; Vol. II, 1888–'91, 96 pp.; Vol. III, 1892, pp. 1–24.

NEW HAVEN, CONN.—*Connecticut Academy of Arts and Sciences:* Transactions, Vol. VIII, Parts I and II, 560 pp., 44 pl., some of them colored; contains a large number of articles on original work in chemistry and the following biological articles: XI.—New England Spiders of the families Drassidæ, Agalenidæ, and Dysderidæ, by J. H. Emerton; 40 pp., pl. 3–8. XII.—The Development of a Paleozoic Poriferous Coral, by C. E. Beecher; 8 pp., pl. 9–13. XIV.—New England Spiders of the family Attidæ, by J. H. Emerton; 43 pp., pl. 16–21. XV, XVI.—A Provisional List of the Hepaticæ of the Hawaiian Islands, and an Arrangement of the Genera of Hepaticæ, by A. W. Evans; 28 pp., pl. 22, 23. XIX.—Notes on the Fauna of the Island of Dominica, by G. E. and A. H. Verrill; 41 pp., pl. 25–27. XXI.—New England Spiders of the family Thromsidæ, by J. H. Emerton; 24 pp., pl. 28–32. XXII–XXIV.—Marine Nemerteans, Dinophilidæ, and Marine Planarians of New England, by A. E. Verrill; 140 pp., pl. 33–44.

Vol. IX, Part I, 350 pp., contains theses on Mathematical Investigations in the Theory of Value and Prices, by Dr. Irving Fisher, 124 pp., and Studies in the English Mystery Plays, by Charles Davidson, 173 pp.; also, an article on Papoid Digestion, by R. H. Chittenden, 35 pp.

Yale University: Report of the President for the year 1890, 80 pp.

NEWPORT, R. I.—*The Newport Natural History Society:* Proceedings, Document VII, 1889–'90, A Catalogue of the Birds of the Virginias, by Wm. C. Rives, M. D., 100 pp.

NEW YORK, N. Y.—*Central Park, Wm. A. Conklin, Director:* Report of the Central Park Menagerie, 1891, 48 pp.

Columbia College: Bulletin of the Torrey Botanical Club, Vol. XVII, 1890, 332 pp., 13 pl.; Vol. XVIII, 1891, 382 pp., 11 pl.; Vol. XIX, 1892, Nos. 1 to 10, 324 pp., 12 pl.

Cooper Union: Thirty-first Annual Report of the Trustees of the Cooper Union for the Advancement of Science and Art, May 29, 1890, 68 pp.

Electrical Age Publishing Company: Electric Age, weekly, various sizes, well illustrated. Vol. VIII, 1890, Nos. 44–52, 26x35 cm., 100 pp.; Vol. IX, 1891, Nos. 1–5, same size, 68 pp.; Electrical Age, Vol. IX, 1891, Nos. 6–52, 29x40 cm., pp. 69–686; Vol. X, 1892, Nos. 1–17, same size, pp. 1–204; Vol. X, Nos. 18–43, 22x31 cm., pp. 205–676; Street Railway News, Vol. I, Nos. 1–25, July 1, 1891, to December 25, 1891, 29x40 cm., 220 pp.

Electrical Review Publishing Co.: Electrical Review, a weekly journal of electric and scientific progress, 29x40 cm., finely illustrated. Vol. XVII, Nos. 9–26, October 25, 1890, to February 21, 1891 pp. 101–318; Vol. XVIII, 1891, 26 numbers, 344 pp.; Vol. XIX, 1891–'92, 370 pp., including one magnificent decennial number; Vol. XX, 1892, 340 pp.; Vol. XXI, Nos. 1–9, August 27 to October 22, 1892, 108 pp.

The W. J. Johnston Company, Limited: The Electrical World, a weekly review of current progress in electricity, and its practical applications, 29x40 cm., profusely illustrated. Vol. XVII, 26 numbers, January 3 to June 27, 1891, 490 pp.; Vol. XVIII, July 4 to December 26, 1891, 474 pp.; Vol. XIX, 1892, 448 pp.; Vol. XX, Nos. 1–17, July 2 to October 22, 1892, 254 pp. With all this there is with each number from 32 to 52 pages of advertising.

Linnæan Society: Abstract of the Proceedings, for the year ending March 6, 1891, 16 pp.

New York Academy of Sciences: Annals, Vol. V, Nos. 7 and 8, July, 1890, pp. 201–306, 1 pl., contains Local Floras of the United States and British America, by N. L. Britton. Vol. VI, Nos. 1–4, December, 1891, pp. 1-216, contains a Catalogue of Rutherford's Photographic Plates of the Sun, the Moon, and the Stars, by John K. Rees; and Coleopterological Notices, III, by Thos. L. Casey.

Transactions, Vol. X, 1890-'91, Nos. 1-6, 112 pp.; Vol. XI, 1891-'92, Nos. 3-5, pp. 41-104, 4 pl., contains a List of Species of the Genera Scirpus and Rhynchospora occurring in North America, by N. L. Britton.

New York Microscopical Society: Journal, a quarterly magazine. Vol. VII, 1891, 144 pp., 4 pl.; Vol. VIII, 1892, 120 pp., 8 pl. Contains a Biographical Catalogue of the Described Transformations of North American Coleoptera, by Wm. Beutenmüller, 52 pp.; On the Structure of the Pleurosigma Valve, by T. F. Smith, 1 pl.; Diatom-structure — the Interpretation of Microscopical Images, by Jacob D. Cox, 12 pp., 1 pl.; What is a Diatom — a lecture by Chas. F. Cox, 28 pp.; Cordylophora lacustris, and Five New Forms of Animal Life, by Stephen Helm, 8 pp., 3 pl.; The Anatomy of a Stem of Wistaria sinensis, by Carlton C. Curtiss, 12 pp., 3 pl.

W. A. Conklin, Ph. D., and R. S. Huidekoper, M. D.: The Journal of Comparative Medicine and Veterinary Archives, monthly. Vol. XI, Nos. 11 and 12, pp. 597-732; Vol. XII, 1891, 712 pp.; Vol. XIII, Nos. 1-9, 580 pp.

NIAGARA FALLS, N. Y.—*David F. Day:* A Catalogue of the Flowering and Fern-like Plants Growing without Cultivation in the Vicinity of the Falls of Niagara, 6 pp.

NORMAL, ILL.—see Champaign.

OBERLIN, OHIO.—*Oberlin College:* Laboratory Bulletin—Flora of Lorain County, Ohio; A Preliminary List of the Flowering and Fern Plants, compiled by Albert A. Wright. 30 pp., and map of Lorain county.

Laboratory Bulletin No. 2. Descriptive List of the Fishes of Lorain County, by Lewis M. McCormick. 36 pp., 14 pl., and map.

ONEIDA, N. Y.—*Albert P. Brigham:* The Geology of Oneida County, N. Y., 18 pp., and Rivers and the Evolution of Geographic Forms, by Albert P. Brigham, 22 pp.

PALO ALTO, CAL.—*Dr. J. C. Branner, Leland Stanford Junior University:* Arkansas Geological Survey, seven volumes, bound in black cloth, as follows:

Annual Report for 1888, Vol. I, 352 pp., 2 maps, 1 in pocket. Contains a general report on the structural and economic geology of southwestern Arkansas, by T. B Comstock, with maps of the region southwest from Little Rock and the Hot Springs.

Vol. II, 336 pp., 7 pl., 1 map in pocket. Contains reports on the Neozoic Geology of Southwestern Arkansas, by Robert T. Hill, and the Northern Limit of the Mesozoic Rocks in Arkansas, by O. P. Hay, giving the results of the combined work of the U. S. Geological Survey and of the Geological Survey of Arkansas, upon the mesozoic geology of the state; to which is added a chapter on the manufacture of Portland cement, by John C. Branner.

Vol. III, 132 pp., 1 map in pocket. Contains a report on the Geology of the Coal Regions; a Preliminary Report upon a Portion of the Coal Regions of Arkansas, by Arthur Winslow, with map of the coal regions east and south from Fort Smith.

Annual Report for 1890, Vol. I, 672 pp., 16 pl., 46 figures in text, 1 map in pocket. Contains a report on Manganese: its Uses, Ores, and Deposits, by R. A. F. Penrose, jr., Ph. D.

Vol. II, 496 pp., 22 pl., including 2 relief maps, 44 figures in text, 6 maps in pages, and 2 maps in pockets; also a portrait of John Francis Williams, the author, who died November 9, 1891, just as the printing of the report was completed, and before its distribution. Contains a report on The Igneous Rocks of Arkansas, by J. Francis Williams.

Annual Report for 1891, Vol. I, 152 pp., 1 map in pocket. Contains a report on The Mineral Waters of Arkansas, by John C. Branner. Ph. D., State Geologist.

Annual Report for 1892, Vol. I, 168 pp., 4 pl., and a two-page map. Contains a report on The Iron Deposits of Arkansas, by R. A. F. Penrose, jr., Ph. D.

PEORIA, ILL.—*Peoria Scientific Association.*

PHILADELPHIA, PA.—*Academy of Natural Sciences of Philadelphia:* Proceedings, 1891, Part III, pp. 409-536, 3 pl.; 1892, Parts I and II, 320 pp., 13 pl. Contains Notes on Some Little-known American Tortoises, by Dr. G. Baur; The Summer Birds of Harvey Lake, Pa., by Witmer Stone; Catalogue of the Corvidæ, Paradiseidæ and Oriolidæ in the Academy of Natural Sciences of Philadelphia, by W. Stone; The Spider Fauna of the Upper Cayuga Basin, by Nathan Banks; The Birds of Southeastern Texas and Southern Arizona, 1891, by Samuel N. Rhoads; Birds Collected by the West Greenland Expedition, by Witmer Stone; Contributions to the Life Histories of Plants, No. 7, by Thomas Meehan; Mineral Localities of Philadelphia and Vicinity, by Theo. D. Rand, William W. Jefferis, and J. T. M. Cardeza, M. D.; A Contribution to the Knowledge of the Fauna of the Blanco Beds of Texas, by Edw. D. Cope; A Catalogue of the Fishes of Greece, with notes on the names now in use and those employed by classical authors, by H. A. Hoffman and David Starr Jordan; A Revision of the North American Creodonta, with notes on some genera which have been referred to that group, by W. B. Scott.

American Entomological Society: List of Coleoptera of America, North of Mexico, by Samuel Henshaw. 162 pp., 9,238 plus numbers.

American Philosophical Society: Proceedings, Vol. XXVIII, No. 134, December, 1890, pp. 227 to 270, contains: Note on the Puquina Language of Peru, by Daniel G. Brinton. Vol. XXIX, 1891, Nos. 135 and 136, 226 pp., contains: Vocabularies from the Mosquito Coast, by Daniel G. Brinton; On the Grapeville Gas Wells, and a Boring through 200 feet of Lias, in Eastern Pennsylvania, by J. P. Lesley; Possible Sterilization of City Water, by R. Meade Bache; Notes on Calospasta Lec., by Geo. H. Horn; The Electrolysis of Metallic Formates, by H. S. Warwick; Observations on the Flora of Northern Yucatan, by Prof. Angelo Heilprin; Vocabularies of the Tlingit, Haida and Tsimshian Languages, by Dr. Franz Boas; A Mythic Tale of the Isleta Indians, by Albert S. Gatschet. Vol. XXX, 1892, Nos. 137 and 138, 268 pp., contains: The Temperate and Alpine Floras of the Giant Volcanoes of Mexico, by Prof. Angelo Heilprin; Observations on the Chinantec Language of Mexico, on the Mazatec Language of Mexico and its Affinities, and Studies in South American Native Languages, by Prof. Daniel G. Brinton; A Contribution to the Vertebrate Palæontology of Texas, by Prof. E. D. Cope; A Sketch of the Life of Joseph Leidy, M. D., LL. D., by W. S. W. Ruschenberger; The Osteology of Lacertilia (with five pl.), Some New and Little-known Paleozoic Vertebrates, and On the Skull of the Dinosaurian Lælaps incrassatus, by E. D. Cope; Second Contribution to the Study of Folk-lore in Philadelphia, by Henry Phillips; Notes on Fuegian Languages, by D. G. Brinton, M. D. List of Surviving Members of the American Philosophical Society, corrected to January 9, 1892, by Henry Phillips, jr., 16 pp.

Transactions of the American Philosophical Society, 24x29 cm., Vol. XVII, Parts I and II, 64 pp., 24 pl., contains: Article I.—Description of a Skull of Megalonyx leidyi, n. sp. (with 5 pl.), by Josua Lindahl, Ph. D. Article II.—On the Homologies of the Posterior Cranial Arches in the Reptilia (with 5 pl.), by E. D. Cope. A Synopsis of the Species of the Teïd Genus Cnemidophorus (with 8 pl.), by E. D. Cope. Article IV.—The Tribute Roll of Montezuma (with 6 pl.), edited by Dr. Daniel G. Brinton, Henry Phillips, jr., and Dr. J. Cheston Morris.

The Numismatic and Antiquarian Society of Philadelphia: Proceedings for the years 1887–1889. 86 pp., numerous plates and figures; for the years 1890 and 1891, 139 pp., with plates and figures.

Pennsylvania Geological Survey—J. P. Lesley, State Geologist: Anthracite Coal Field Atlas, each part in a cloth cover. Eastern middle, Part 3, 13 sheets. Northern, Part 3, 8 sheets; Part 4, 8 sheets; Part 5, 7 sheets; Part 6, 5 sheets. Southern, Part 2, 13 sheets; Part 3, 12 sheets; Part 4, 8 sheets; Part 5, 9 sheets; Part 6, 9 sheets. Western middle, Part 3, 8 sheets.

Atlas to Reports HH and HHH, 5 sheets, with 56 pages of revisions and corrections to reports on Cambria and Somerset counties, 1888, as an appendix to Reports H_2 and H_3, 1877.

Catalogue of the State Geological Museum, Part III, 260 pp., and enumerating and naming about 15,000 specimens.

Dictionary of Fossils, 3 volumes, 1,284 pp., illustrated by about 10,000 cuts of fossils, and accompanied by 54 pages of corrections of errata.

Oil and Gas Fields of Western Pennsylvania, Seventh Report, with additional unpublished well records, by John F. Carll. 356 pp., 6 maps and charts in pockets.

Report of Progress F_3, 1888–'89: Report on the geology of the four counties, Union, Snyder, Mifflin, and Juniata, with descriptions of the Clinton fossil ore mines, Marcellus carbonate iron-ore mines, Oriskany glass-sand mines, and Lewistown limestone quarries, by E. V. d'Invilliers. 444 pp., 2 geological maps in pockets.

Summary Final Report, 1892: A Summary Description of the Geology of Pennsylvania, in 3 volumes, by J. P. Lesley, State Geologist. Vol. I, 740 pp., 90 pl., describing the Laurentian, Huronian, Cambrian and Lower Silurian formations. Vol. II, 934 pp.; including pp. 721 to 1628, and illustrated with 106 plates of fossils, maps, sections, diagrams, etc.

A. E. Foote, M. D., 4116 Elm Avenue: The Grasses of the United States, by Dr. Geo. Vasey—Department of Agriculture Special Report No. 63, 48 pp.

A Descriptive Catalogue of the Grasses of the United States, including the grass collections at the New Orleans Exposition, by Dr. Geo. Vasey—Department of Agriculture Report, 112 pp.

The Grasses and their Culture, by John Stanton Gould—Annual Report of New York State Agricultural Society, 212 pp., 74 pl.

Grasses and Forage Plants of Nebraska, by Charles E. Bessey, and Catalogue of the Plants of Nebraska, by Herbert J. Webber, 162 pp. From the Report of the Nebraska State Board of Agriculture, 1889.

Grasses of North America for Farmers and Students, comprising chapters on their physiology, composition, selection, improving, cultivation; management of grass lands; also chapters on clovers, injurious insects, and fungi, by W. J. Beal, Ph. D., Professor of Botany in Michigan Agricultural College. 472 pp., bound in cloth, 176 plates and figures in text.

The True Grasses, by Eduard Hackel, translated from Die natürlichen Pflanzenfamilien, by F. Lamson-Scribner and Effie A. Southworth. 236 pp., 110 figures, and one full-page illustration of Bambusa arundinacea Retz.

Naturalists' Leisure Hour and Monthly Bulletin, 32 pp., monthly; mainly lists of scientific books.

Dr. Persifor Frazer, Room 1012 Drexel Building, Fifth and Chestnut streets: The Persistence of Plant and Animal Life under Changing Conditions of Environment — an address before the Pennsylvania Horticultural Society, 14 pp.

The Philadelphia Meeting of the International Congress of Geologists — editorial comment, 10 pp. From the American Geologist, June, 1890.

Descriptive Table of Elements, 1891, 2 pp.

Thomas Sterry Hunt, M. A., D. Sc., LL. D., F. R. S.—A Memoir, 14 pp., with portrait. From the American Geologist.

Henry Phillips, jr.: Supplementary Report of the Committee Appointed to Consider an International Language, 8 pp. Read before the American Philosophical Society, December 7, 1888.

Chas. E. Smith, 216 South Fifteenth street: Pens and Types, by Benjamin Drew, 214 pp., bound. Hints and helps for those who write, print, teach, read, or learn.

Report on the Birds of Pennsylvania, with special reference to the food habits, based on over 4,000 stomach examinations, by B. H. Warren, M. D., 434 pp., 100 colored plates of 161 birds.

Proceedings of the Opening of the Williamson Free School of Mechanical Trades, October 31, 1891, 72 pp., 5 plates, and portrait of I. V. Williamson.

A Sketch of the Life of Joseph Leidy, M. D., LL. D., by W. S. W. Ruschenberger, M. D., 64 pp., with lithograph portrait. Reprinted April 25, 1982, from Proc. Amer. Phil. Soc., Vol. XXX.

The Portland Catalogue of Maine Plants, second edition, by M. L. Fernald, 32 pp., with blank interleaves. From the Proceedings of the Portland Society of Natural History, 1892.

University of Pennsylvania: Catalogue and Announcements, 1891–'92, 276 pp.

PORTLAND, MAINE.—*Portland Society of Natural History:* The Portland Catalogue of Maine Plants. Second Edition, by Merritt L. Fernald. Proceedings, 1892, pp. 41–72.

PORTLAND, ORE.—*Library Association:* 27th and 28th Annual Reports, 1890–'91, 32 pp.

POUGHKEEPSIE, N. Y.—*Vassar Brothers Institute:* Transactions of Vassar Brothers Institute and its Scientific Section, Vol. V, 1887–'90, 192 pp., with portrait of W. G. Stevenson. Contains numerous original scientific papers of great interest.

RACINE, WIS.—*Racine College:* Circular for the Academic Year 1890–'91, illustrated.

ROCHESTER, N. Y.—*Rochester Academy of Science:* Proceedings. Brochure 2 of Vol. II, 1892, pp. 113–200.

SACRAMENTO, CALIF.—*California State Board of Forestry, Sands W. Forman, Secretary:* Third Biennial Report, for the years 1889–'90, 212 pp., 32 full-page photo-engravings of California trees.

State Board of Horticulture of the State of California, B. M. Lelong, Secretary:

Annual Report for 1889, 536 pp., bound in black cloth, illustrated by 4 colored plates and 138 figures in text.

Annual Report for 1891, 488 pp., bound, 5 colored plates and 6 figures.

Bulletins—A Compilation of the Laws to Protect and Promote the Horticultural Interests of the State; also Remedies for the Destruction of Injurious Insect Pests, and suggestions thereto, 28 pp.

Report of the County Board of Horticultural Commissioners of Sutter County, September, 1889, 8 pp.

Fruit Culture: Sour Orange Stock; Fertilizing and Methods of Compounding Fertilizers; Injurious Insect Pests; Parasites; by B. M. Lelong, Secretary. 20 pp., 7 cuts.

Destructive Insects: their Natural Enemies, Remedies, and Recommendations, by Alex. Craw, entomologist. 52 pp., 62 cuts, and 1 col. pl.

Citrus Fruits: Part I, Fifteen Years with the Lemon, by G. W. Garcelon. Part II, New Varieties of Citrus Fruits, by B. M. Lelong. 40 pp., 1 col. pl., 6 cuts, and map.

California Olive Industry: Proceedings of the Olive Growers' Convention, held under the auspices of the State Board of Horticulture, at San Francisco, July 8, 1891. 40 pp.

California Olive Industry: Proceedings of the Second Convention, held at San Francisco, July 21, 1892. 64 pp.

Peach Yellows: A Warning to Fruit Growers; Danger of Introduction into California; Warning to Intending Purchasers, and Recommendations, by B. M. Lelong. 30 pp., 3 pl., and map.

No. 57. Internal Parasites discovered in the San Gabriel Valley, by Alexander Craw. 8 pp.

No. 58. Peach-Tree Borers infesting Deciduous Fruit Trees, by Alex. Craw. 8 pp.

No. 59. A Compilation of the Laws to Protect and Promote the Horticultural Interests of the State. 8 pp.

No. 60. Regulations to Prevent the Introduction and Spread of Injurious Insect Pests and Contagious Diseases among Fruit and Fruit Trees, etc. 14 pp.

No. 61. Crops and Fertilizers, with Reference to California Soils and Practice, by E. W. Hilgard, 16 pp.

California Prune Industry: History and Importance of the Prune Industry, Methods of Cultivation, Varieties, Picking, Curing, Packing, and Production, by B. M. Lelong, 34 pp., illustrated.

Propagation: The Rearing of Citrus and Deciduous Trees from Seed; Budding, Grafting, and Appliances, by B. M. Lelong, 40 pp., 50 cuts.

California Scale for Judging Citrus Fruits, 8 pp.

California State Mining Bureau, Wm. Irelan, jr., State Mineralogist:

Eighth Annual Report of the State Mineralogist, for the year 1888, 948 pp., illustrated by numerous figures, plates, plats, plans, diagrams and other drawings.

Ninth Annual Report, for 1889, 352 pp., bound in cloth, illustrated by 18 photograph plates, 6 colored lithograph plates, 12 cross sections, and several small maps.

Tenth Annual Report, for 1890, 984 pp., illustrated by numerons photographic and other plates, maps, cross sections, etc., and accompanied by a pocket holding five large geological maps.

ST. LOUIS, MO.—*The Academy of Science of St. Louis:* Transactions, Vol. V, 1889-'90, 576 pp.

Vol. VI, No. 1. Appendix to the Catalogue of the Flora of Nebraska, by H. J. Webber. 48 pp.

No. 2. A Geometrical Construction for Finding the Foci of the Sections of a Cone of Revolution, by Edmund A. Engler, pp. 49-56.

No. 3. The Mapping of Missouri, by Arthur Winslow, pp. 57-100, with map of the Higginsville district.

The Missouri Botanical Garden (Shaw's), Prof. Wm. Trelease, Director: Annual Report, 1890, bound in green cloth, 166 pp., antique paper, 19 phototypic pl., 5 sectional plats of the garden.

Second Annual Report, 1891. 118 pp., 4 photo. and 48 litho. plates, 5 sectional plats of the garden. Contains a paper on a Revision of the American Species of Epilobium, by Wm. Trelease.

Third Annual Report, 1892. 170 pp., 58 plates. Book contains papers on Revision of Rumex, by Wm. Trelease; Yucca Moth and Yucca Pollination, by C. V. Riley, Ph. D.

St. Louis Public Library: Annual Report, 1890, 44 pp.

William Trelease: Revision of North American Linaceæ, 20 pp. From Trans. St. Louis Acad. Sci.

Revision of North American Ilicineæ and Celastraceæ, 16 pp. From Trans. St. Louis Acad. Sci.

Washington University: Catalogue, 1890-'91, 208 pp., several illustrations.

The Total Eclipse of the Sun, January 1, 1889: Report of Washington University eclipse party. 25x30 cm., 40 pp., 8 pl.

SAINT PAUL, MINN.—*Geological Survey*—see Minneapolis.

Saint Paul Public Library: Ninth Annual Report, 1890, 12 pp.

SALEM, MASS.—*Essex Institute:* Bulletin, Vol. XXII, Nos. 10 to 12, 1890, pp. 115 to 160; Vol. XXIII, 1891, 160 pp.; Vol. XXIV, 1892, Nos. 1-9, pp. 1-136.

Peabody Academy of Science.

SAN DIEGO, CALIF.—*C. R. Orcutt:* The West American Scientist, Vol. VII, 1891, Nos. 56 to 63, pp. 73 to 276; Vol. VIII, No. 64, March, 1892, 30 pp.

SAN FRANCISCO, CALIF.—*California Academy of Sciences:* Proceedings, second series, Vol. II, 1889, 396 pp., 12 pl., and a map. Contains Petrographical Notes from Baja California, Mex.; Nests and Eggs of Californian Birds; South American Nematognathi; New Birds from Lower California, and General Ornithological Notes; Plants from Baja California; North American Euphorbiaceæ; Birds of Lower California.

Vol. III, Part 1, 1891, 210 pp., 2 pl. Contains Additions to the Fauna of San Diego; Notes on the Geology of Baja California; Land and Fresh-water Shells of Lower California; New Californian Carices; Flora of the Cape Region of Baja California.

Occasional Papers, III: Evolution of the Colors of North American Land Birds, by Charles A. Keeler. 364 pp., 19 pl., some of them colored.

San Francisco Free Public Library: Report of the Board of Trustees, 1890. 16 pp.

Technical Society of the Pacific Coast: Transactions, Vol. VII, No. 2, April, 1890, pp. 32-64; No. 3, July, 1890, pp. 65-112; No. 5, January, 1891, pp. 113-192.

Vol. VIII, No. 1, June, 1891, 118 pp., contains articles on Street Pavements; Hydro-Steam Elevator; Abrasive Cutting; Nicaragua Canal, with maps; Cyclone Belts.

Vol. IX, No. 12, pp. 287-304, contains Railway Entrances to San Francisco; and A Topographical Map of California.

SANTA BARBARA, CALIF.—*Santa Barbara Society of Natural History:* Bulletin, Vol. I, No. 2, 60 pp., 6 pl., contains Ferns of the Channel Islands; Indigenous Shrubs of Santa Barbara County; Mollusca of Santa Barbara County; New Shells from Santa Barbara Channel; Solfataras in Vicinity of Santa Barbara; Lyonothamnus asplenifolius.

SEDALIA, MO.—*F. A. Sampson:* Pettis County and Sedalia, Mo. 16 pp., illustrated.

Notes on Palæozoic Crustaceæ, No. 1, on Some New Sedalia Trilobites, by A. W. Vogdes. From Trans. St. Louis Acad. Sci. 4 pp., 4 pl.

Notes on the Subcarboniferous Series at Sedalia, Mo., by F. A. Sampson; Description of Two New Species of Carboniferous Trilobites, by A. W. Vogdes. From Trans. N. Y. Acad. Sci. 6 pp.

History and Publications of the Missouri State Horticultural Society, by F. A. Sampson. 16 pp.

A Bibliography of the Geology of Missouri, by F. A. Sampson. Bulletin No. 2, Geology of Missouri. 180 pp.

A Description of Some Lower Carboniferous Crinoids from Missouri, by S. A. Miller. Bulletin No. 4, Geology of Missouri. 40 pp., 5 pl.

Sedalia Natural History Society: Bulletin No. 1, 30 pp., contains: Shells of Pettis County, Missouri, by F. A. Sampson, 14 pp., and Pettis County Pentremites, by Dr. G. Hambach, 2 pp.

SOUTH BETHLEHEM, PA.—*Lehigh University:* Register, 13x18 cm., 1890-'91, 180 pp.; 1891-'92, 188 pp.

SPRINGFIELD, ILLS.—*Geological Survey of Illinois, A. H. Worthen, Director:* Report, Vol. VIII, Geology and Palæontology, edited by Josua Lindahl, State Geologist. Geology, by A. H. Worthen; Palæontology, by A. H. Worthen, Charles Wachsmuth, Frank Springer, E. O. Ulrich, and Oliver Everett. 19x27 cm., 740 pp., with an appendix of 152 pp., containing an account of the life and scientific work of Prof. Amos Henry Worthen, with a portrait; a general index to volumes I to VIII, and a geological map of the state, accompanied by a separate volume of 78 lithograph plates, containing some 1,600 figures of fossils. Both volumes substantially bound in cloth.

TACOMA, WASH.—*Tacoma Academy of Science:* Proceedings—Paper by Hon. James Wickersham: Is it Mt. "Tacoma" or Mt. "Ranier"—What do History and Tradition Say? 16 pp.

TERRE HAUTE, IND.—*Barton W. Evermann:* A Review of the Species of Gerres found in American Waters, by B. W. Evermann and Seth E. Meek. 9 pp. Proc. Acad. Sci., Phila., 1883.

List of Fishes collected in Harvey and Cowley Counties, Kansas, by Barton W. Evermann and Morton W. Fordice. 1 p. Proc. Acad. Nat. Sci., Phila., 1885.

Birds observed in Ventura County, Calif., by Barton W. Evermann. 10 pp. Pacific Science Monthly, Jan., 1886.

Notes on a Collection of Fishes from the Monongahela River, by Barton W. Evermann and Charles H. Bollman. April, 1886. 6 pp.

The Yellow-billed Magpie, by Barton W. Evermann. American Naturalist, July, 1886.

A List of the Fishes observed in the Vicinity of Brookville, Franklin County, Indiana, by Barton W. Evermann. Bull. No. 2, Brookville Soc. Nat. Hist., 1886.

A Revision of the American Species of the genus Gerres, by Barton W. Evermann and Seth E. Meek. 17 pp. Proc. Acad. Nat. Sci., Phila., 1886.

Bird Migration, by Barton W. Evermann. 8 pp. Pop. Sci. Monthly, 1887.

Description of a New Species of Fish from Tippecanoe River, Indiana, by David Starr Jordan and Barton Warren Evermann. 1 p.

Description of Eighteen New Species of Fishes from the Gulf of California, by Oliver P. Jenkins and Barton W. Evermann. 22 pp. Proc. U. S. Nat. Mus., 1888.

The Wood Ibis in Indiana, by B. W. Evermann. 2 pp. The Auk, April, 1889.

TOPEKA, KANS.—*Kansas State Board of Agriculture, M. Mohler, Secretary:* Seventh Biennial Report, 1889-'90, 552 pp., 5 pl., 3 geological sketches, 9 weather maps, and map of the state. Contains articles on Geology of Kansas Salt, by Robert Hay; Loco Weeds, by Dr. L. E. Sayre; Irrigation in Western Kansas: Its Water Supply and Possibilities, by Robert Hay; Smuts of Farm Crops, by Dr. W. A. Kellerman; Hot Winds of the Plains, by George E. Curtis, with 9 maps; Chinch-bugs: Experiments in 1890 for their Destruction by Artificial Introduction of Contagious Diseases; Forestry, an address by B. E. Fernow, Chief of Forestry, Washington, D. C.; Irrigation for Homesteaders in Western Kansas, by Col. W. Tweeddale, civil and hydraulic engineer, Topeka, Kans.; Meteorological Summary for 1889, by Prof. J. T. Lovewell.

Eighth Biennial Report, 1891-'92, 600 pp., 25 figs., geological map, and map of the state. Contains papers on Geology and Mineral Resources of Kansas, by Robert Hay, F. G. S. A.; Loco Weed, by L. E. Sayre, Ph. G.; Salt in Kansas: Its Composition and Methods of Manufacture, by Prof. E. H. S. Bailey; Key to Kansas Trees in their Winter Condition, by A. S. Hitchcock, State Agricultural College; Practical Benefits of a Geological Survey—some of the results accomplished in Kansas by the United States Geological Survey, by F. H. Newell; Chinch-bugs: Experiments in 1892 for their Destruction by Disease, by Chancellor F. H. Snow, University of Kansas; A Preliminary Report upon the Variety and Distribution of Kansas Trees, by S. C. Mason, State Agricultural College; The Outlook of Meteorology in Kansas, by Prof. J. T. Lovewell, Washburn College.

Kansas State Historical Society, F. G. Adams, Secretary: Seventh Biennial Report, for the two years ending November 18, 1890, 124 pp.; Eighth Biennial Report, for the period ending November 15, 1892, 136 pp.

State Inspector of Coal Mines, John T. Stewart, Inspector: Fourth Annual Report, 1890, 116 pp.; Fifth Annual Report, 1891, 86 pp., bound.

Kansas State Library, H. J. Dennis, State Librarian: Seventh Biennial Report, for the period ending June 30, 1890, 60 pp.; Eighth Biennial Report, for the period ending June 30, 1892, 86 pp.

Kansas Weather Service, Prof. J. T. Lovewell, Director: Several monthly reports, irregular.

Chas. S. Prosser: Notes on the Geology of the Skunnemunk mountain, Orange county, N. Y., by C. S. Prosser, Professor of Natural History, Washburn College, Topeka. 18 pp. From Trans. N. Y. Acad. Sci.

W. L. Schenck, M. D.: Address on State Medicine, by W. L. Schenck, M. D., Professor of State Medicine and Pathology in Kansas Medical College. Delivered at the forty-second annual meeting of the American Medical Association, at Washington, D. C., May, 1891. 20 pp. From Journal of Amer. Med. Association.

Bernard B. Smyth, Librarian: Check-list of the Plants of Kansas, August, 1892, by B. B. Smyth. 34 pp., botanical map of Kansas.

The Educationist, by Geo. W. Hoss, Topeka; Vol. III, 1881, 382 pp., bound; Vol. IV, 1882, 350 pp. bound; Vol. V, 1883, 412 pp.; Vol. VI, 1884, 408 pp.; Vol. VII, No. 1, Jan., 1885, 32 pp.

Reports of the State Entomologist of Illinois: Eighth Report, for the year 1878, by Cyrus Thomas, Ph. D., State Entomologist, 222 pp., 46 figs. in text. Ninth Report, for 1879, by Cyrus Thomas, 150 pp., 30 figs. Tenth Report, for 1880, by Cyrus Thomas, 244 pp., 79 figs., includes a report of 40 pp. on The Hessian Fly: Its Ravages and Habits, and the Means of Preventing its Increase, by Dr. A. S. Packard, jr., with 2 pl. Eleventh Report, for 1881, by Cyrus Thomas, 110 pp. Twelfth Report, for the year 1882, by S. A. Forbes, State Entomologist, 164 pp., 30 figs. Thirteenth Report, for 1883, by S. A. Forbes, 212 pp., 15 pl. Fourteenth Report, for 1884, by S. A. Forbes, 144 pp., 12 pl., to which is appended a general index of 120 pp. to the entire fourteen reports. Fifteenth Report, for the years 1885 and 1886, by S. A. Forbes, 116 pp., 4 figs. Miscellaneous Essays on Economic Entomology, by S. A. Forbes, State Entomologist, and his entomological assistants, 1886, 130 pp.

Science, 22x30 cm., weekly, N. D. C. Hodges, 874 Broadway, N. Y. Vol. XX, July 1, 1892, to October 28, 1892, 252 pp.

The Scientists' International Directory, containing the names, addresses, special departments of study, etc., of professional and amateur naturalists, chemists, physicists, astronomers, etc., compiled by Samuel E. Cassino, 1892. 440 pp.

Smithsonian Reports—Annual Reports of the Board of Regents of the Smithsonian Institution, for the year 1872, 456 pp.; for 1873, 452 pp.; for 1874, 416 pp.; for 1875, 422 pp.; for 1876, 488 pp.; for 1877, 500 pp.; for 1879, 632 pp.; for 1880, 772 pp.; for 1883, 960 pp.

United States Coast and Geodetic Surveys, 24x29 cm., bound in leather. Report for 1882, 566 pp., 33 large maps, folded. Report for 1884, 618 pp., 23 large maps, folded. Report for 1885, 516 pp., 26 large maps, folded. Report of the U. S. Nicaragua Surveying Party, 1885, by Civil Engineer A. G. Menocal, U. S. N., 50 pp., with sketch. War Department—Government Land and Marine Surveys of the World, prepared by Captain George M. Wheeler, Corps of Engineers, U. S. A., 586 pp., 4 maps, folded, and 7 quarto plates, consisting of heliogravure, lithograph, photolithograph, photozincograph and chromolithographic maps of parts of Switzerland, Prussia, Spain, Saxony, Java, and Algeria.

U. S. Geological and Geographical Surveys, 24x30 cm., bound in cloth. Report on the Geology of the Eastern portion of the Uinta Mountains, and a region of country adjacent thereto, by J. W. Powell. 218 pp., several plates and figures. Geology of the Henry Mountains, by G. K. Gilbert. 160 pp., 71 figures, some of them full-page size, and 5 quarto stereogram and relief maps of the Henry mountains. Contributions to North American Ethnology, Vol. IV, Houses and House Life of the American Aborigines, by Lewis H. Morgan. 282 pp., 54 figs., including several full-page, 5 full-page heliotype plates, and 1 colored lithograph plate.

Western School Journal, 20x27 cm., successor to The Educationist, Topeka. Vol. I, February to July, 1885, 192 pp.; Vol. II, Nos. 1 to 9, December, 1885, to August, 1886, 192 pp.; Vol. III, 1887, 272 pp.; Vol. IV, 1888, Nos. 1 to 7, 168 pp.; Vol. V, 1889, 286 pp.; Vol. VI, 1890, 288 pp.; Vol. VII, 1891, 296 pp.; Vol. VIII, 1892, Nos. 1 to 10, 250 pp.

William Tweeddale: Water Purification, by Col. Wm. Tweeddale, civil and hydraulic engineer, Topeka. 6 pp. Read before the State Sanitary Convention, Manhattan, Kans., December 5, 1890.

Washburn College Laboratory: Bulletin, No. 10, Vol. II, pp. 65-68, December, 1889. Contributions to the Paleontology of the Plains, No. 1, by Francis W. Cragin, S. B. No. 11, Vol. II, pp. 69-80, March, 1890. Consists entirely of a paper "On the Sandstone and the Neocomian Shales of Kansas," by F. W. Cragin, S. B. 12 pp.

World's Columbian Exposition, Kansas Department: Report of the Board of Managers Kansas Exhibit—Proceedings of the Board. 22 pp.

TRENTON, N. J.—*Dr. G. N. Best, Rosemont, N. J.:* Remarks on the Group Cinnamomeæ of the North American Roses, by G. N. Best. 8 pp. From Bull. Torr. Bot. Club.

Byron D. Halsted, New Brunswick, N. J.: Report of the Botanical Department—a paper on fungous and other diseases of flowers, vegetables, and fruits, accompanied by papers on "A Study of Weed Roots," "The Migration of Weeds," etc., by B. D. Halsted, botanist. 108 pp. From Annual Report New Jersey Agricultural Experiment Station, 1891.

Rollin D. Salisbury, Madison, Wis.: (See Madison.) A Preliminary Paper on Drift or Pleistocene

Formations of New Jersey, by Prof. R. D. Salisbury. 108 pp., 3 pl. 9 fig., and 2 sketches of moraine.

Trenton Natural History Society: Journal.

UNIVERSITY, ALA.—See Montgomery, Ala.

WASHINGTON, D. C.—*Anthropological Society.*—See Smithsonian Miscellaneous Collections.

Biological Society of Washington: Proceedings, Vol. I, 1880–'82, 110 pp. Darwin Memorial Meeting.

Vol. II, 1882–'84, 196 pp. The Principles of Zoögeography, by Theodore Gill; North American Psyllidæ, by C. V. Riley; Certain Phases in the Geological History of the North American Continent Biologically Considered, by Chas. A. White; Plants added to the Flora of Washington, by Lester F. Ward; New North American Birds, by Robert Ridgway; New Birds from Kamtschatka, by Leonhard Stejneger.

Vol. III, 1884–'86, 180 pp. The Application of Biology to Geological History, by Chas. A. White; The Beginnings of Natural History in America, by G. Brown Goode; Additions to the Flora of Washington, by F. H. Knowlton.

Vol. IV, 1886–'88, 166 pp. Descriptions of a new species of bat (*Verpertilio ciliolabrum*) and a new mouse (*Vesperimus anthonyi*) from western United States, by Dr. C. Hart Merriam; The Beginnings of American Science: The Third Century, by G. Brown Goode; Some American Conchologists, by William H. Dall, with portraits of William Stimpson, Capt. Joseph P. Couthouy, and Dr. Isaac Lea; Description of a new fox (*Vulpes macrotis*) from Southern California, by Dr. C. Hart Merriam.

Vol. V, 1888–'89, 86 pp. Deep-sea Mollusks, and the Conditions under which they Exist, by William Healey Dall; The Course of Biologic Evolution, by Lester F. Ward.

Vol. VI, 1890–'91, 100 pp. On Dynamic Influences in Evolution, by Wm. H. Dall; Neo-darwinism and Neo-lamarckism, by Lester F. Ward.

Vol. VII, 1792–'93. The Geographic Distribution of Life in North America, with special reference to the Mammalia, by C. Hart Merriam, M. D. April, 1892. 64 pp., with two-page colored bio-geographic map of North America. Some Inter-relations of Plants and Insects, by C. V. Riley. Ph. D. May, 1892. Pp. 81–109, 15 figs. Third List of Additions to the Flora of Washington, D. C., by Theodor Holm. June, 1892. Pp. 105–132. Plants of the Pribilof Islands, Bering Sea, by Dr. C. Hart Merriam. July 7, 1892. Pp. 133–150. The Fossil Flora of the Boseman Coal Field, by F. H. Knowlton, and other papers. July 27, 1892. Pp. 151–158. Descriptions of a new genus and species of Murine Rodent (Xenomys nelsoni) and nine other new Mammals collected by E. W. Nelson in the states of Colima and Jalisco, Mexico, by C. Hart Merriam, M. D. September 29, 1892. Pp. 159–174.

Chas. W. Smiley, Publisher: The American Monthly Microscopical Journal, containing Contributions to Biology. Vol. XI, 1890, Nos. 10 to 12, pp. 221–288, 3 pl. Vol. XII, 1891, 288 pp., 10 pl. Principal articles: Diatoms: Their Life-history and Classification, by Fred'k B. Carter; Microscopy for Amateurs, by T. C. White; Hints on Histological and Pathological Technique, by Dr. W. C. Borden, U. S. A.; Koch's Cure for Tuberculosis, by Frederick Gaertner, M. D.; Heredity: Its Part in Organic Evolution, by Prof. Henry L. Osborn; The Ammoniacal Fermentation of Urine, by Veranus A. Moore, M. D.; Introduction to Elementary Biology, by Henry L. Osborn; The Germ Theory, by E. H. Griffith; Trichina Spiralis, by Dr. H. M. Whelpley; On a Bacterial Insect Disease, by S. A. Forbes, Ph. D.; Microscopic Structure of Steel, by P. H. Dudley; The Evolution of the Compound Microscope, by J. Melvin Lamb, M. D. Vol. XIII, 1892, Nos. 1 to 9, pp. 1–224, 9 pl.; Observations on Staining the Flagella on Motile Bacteria, by Veranus A. Moore, M. D.; Biological Examination of Potable Water, by Geo. W. Rafter; A Beautiful Rhizopod, by Chas. W. Smiley; Radiolaria: Their Life-history and their Classification, by Fred'k B. Carter; Practical Studies in Biology, by H. L. Osborn; On the Continuity of Protoplasm through the Cell-walls of Plants, by W. J. Beal and J. W. Toumey; Impressions of the Antwerp Microscopical Exposition, by R. H. Ward, M. D.; New Desmids from New Hampshire, by Wm. N. Hastings; Diatoms of the Connecticut Shore, by W. A. Terry; What is a Species in the Diatomaceæ? by Arthur M. Edwards, M. D.

Frederick V. Coville, Botanist, U. S. Dept. Agriculture: Vol. IV, Annual Report 1888, Arkansas Geological Survey. 276 pp., 10 pl., map of Washingion county in pocket. Contains Geology of Washington County, by Frederic W. Simonds; List of the Plants of Arkansas, by John C. Branner and F. V. Coville; and Notes on the Botany of Arkansas, by F. V. Coville.

Smithsonian Institution, S. P. Langley, Secretary: Annual Report of the Board of Regents, for the year ending July, 1885, 996 pp.; for 1886, 878 pp.; for 1887, 734 pp.; for 1888, 840 pp.; for 1890, 808 pp.

Smithsonian Contributions to Knowledge, 25x33 cm., unbound. Vol. X, 1858, contains Nereis Boreali-americana, or Contributions to a History of the Marine Algæ of North America, by W. H. Harvey, M. D., M. R. I. A. Part III, Chlorospermeæ. 142 pp., 14 colored plates. Magnetical Observations in the Arctic Seas, by Elisha Kent Kane, M. D., U. S. N., made during the second Grin-nell Expedition in search of Sir John Franklin, 1853–'54–'55. 72 pp. and 1 pl. A Grammar and Dictionary of the Yoruba Language, with an introductory description of the country and people of Yoruba, by Rev. J. T. Bowen, Southern Baptist missionary. 232 pp., and 1 map.

Vol. XXIII, 1881, contains Lucernariæ and their Allies. A Memoir on the Anatomy and Physiology of Haliclystus auricula and other Lucernarians, with a disscussion of their relations to other Acalephæ, to Beroids, and to Polypi, by Henry James Clark, B. S., A. B. 138 pp., 11 pl. Geology of Lower Louisiana and the Salt Deposit on Petit Anse Island, by Eugene W. Hilgard, Ph. D. 38 pp., 1 map. Internal Structure of the Earth, considered as affecting the Phenomena of Precession and Nutation, being the third of the Problems of Rotary motion, by J. G. Barnard, U. S. A. 16 pp. Classification and Synopsis of the Trochilidæ, by Daniel Giraud Elliott. F. R. S. E 300 pp., 127 figs. Fever: A Study in Morbid and Normal Physiology, by H. C. Wood, A. M., M. D. 266 pp., 5 pl.

Vol. XXIV, 1885, contains: Article I. Results of Meteorological Observations made at Providence, R. I., extending over 45 years, from December, 1831, to December, 1876, by Alexis Caswell. 36 pp. Art. II. Tables and Results of the Precipitation, in Rain and Snow, in the United States: Collected by the Smithsonian Institution, and discussed under the direction of Joseph Henry and Spencer F. Baird, secretaries, by Charles A. Schott, Mem. Nat. Acad. Sci., etc. 270 pp., 5 pl., 5 rainfall maps of the United States, 56x70 cm.

Vol. XXV, 1885, contains: Article I. Prehistoric Fishing in Europe and North America, by Charles Rau. 360 pp., 405 figs., 1 pl. Art. II. Archæological Researches in Nicaraugua, by J. F. Bransford, M. D. 104 pp., 137 figs., 2 pl. of 40 figs. Art. III. Contents of a Bone Cave in the Island of Anguilla, West Indies, by Edward D. Cope. 34 pp., 5 pl.

Vol. XXVI, 1890, contains: Article I. Researches upon the Venoms of Poisonous Serpents: The Venoms of Certain Thanatophideæ, by S. Weir Mitchell, M. D., and Edward T. Reichert, M. D. 196 pp., 5 col. pl. of 17 figs. Art. II. Genesis of the Arietidæ, by Alpheus Hyatt. 272 pp., 6 folding tables, and 14 pl.

No. 671, 1889. The Anatomy of Astrangia Danæ. 6 litho. pl. of 142 figs., by A. Sonrel: 20 pp. explanation of the plates by J. Walter Fewkes.

No. 672, 1889. Six Species of North American Fresh Water Fishes. 6 litho. pl. from drawings by A. Sonrel; 12 pp. explanation of plates by David Starr Jordan.

No. 800, 1891. Plates, prepared between the years 1849 and 1859, to accompany a report on the Forest Trees of North America, by Asa Gray. Contains the following elaborate illustrations: Pl. 1, Magnolia grandiflora; 2, M. glauca; 3, M. umbrella; 4, M. auriculata; 8, Liriodendron tulipifera; 10, Tilia americana; 20, Acer rubrum; 25, A. spicatum; 27, Æsculus glabra; 30, Æ. discolor; 31, Æ. parviflora; 34, Robinia pseudacacia; 35, R. viscosa; 39, Cercis canadensis; 40, Gymnocladus canadensis; 41, Gleditschia triacanthos; 46, Prunus americana; 47, P. chicasa; 48, Cerasus pennsylvanica; 49, C. virginiana; 50, C. serotina; 51, Pyrus coronaria; 63, Cornus alternifolia.

No. 801. Experiments in Aerodynamics, by S. P. Langley, secretary Smithsonian Institution. 120 pp., 11 figs., 10 pl.

Vol. XXVIII, 1892. Life Histories of North American Birds, with special reference to their breeding habits and eggs, by Chas. Bendire, Captain U. S. A. (retired), Honorable Curator United States National Museum. 456 pp., 12 col. litho. pl. of 135 figs. of eggs in natural sizes and colors.

Smithsonian Miscellaneous Collections, regular size, 15x24 cm., unbound. Vol. XVI, 1880, contains: Art. I. Land and Fresh-water Shells of North America, by Geo. W. Tryon, jr. Part IV, Strepomatidæ (American Melanians). 490 pp., 833 figs. II. Catalogue of the Described Diptera of North America, by C. R. Osten Sacken. 324 pp. III. The Toner Lectures: Lecture VII. The Nature of Reparatory Inflammation in Arteries after Ligature, Acupressure, and Torsion, by Edward O. Shakespeare, M. D. 74 pp., 7 pl. VI. List of Described Species of Humming Birds, by Daniel Giraud Elliott. 22 pp.

Vol. XVII, 1880, 1032 pp., relating to The Smithsonian Institution: Its Origin, History, etc. Edited by William J. Rhees, chief clerk of the Institution.

Vol. XVIII, 1880. The Smithsonian Institution: Journal of Proceedings of the Board of Regents, Journal of Executive Committee, Reports of Committees, Eulogies, Statistics, etc., 1846 to 1876. 856 pp.

Vol. XIX, 1880. Proceedings of the United States National Museum. Vol. I, 1878, 524 pp., 5 pl.; Vol. II., 1879, 501 pp., 7 pl.

Vol. XX, 1881. Bulletin of the Philosophical Society of Washington, Vol. I, March, 1871, to June, 1874, 218 pp.; Vol. II, October, 1874, to November, 1878, 452 pp.; Vol. III, November, 1878, to June, 1880, 172 pp.

Vol. XXI, 1881. Memoir of James Smithson, his Bequest, Scientific Writings, etc., by Wm. J. Rhees, Walter R. Johnson, and J. R. McD. Irby. 236 pp., 5 pl. A memorial of Professor Joseph Henry. 532 pp., with portrait.

Vol. XXII, 1882. Proceedings of the U. S. National Museum, Vol. III, 1880, 600 pp.; Vol. IV, 1881, 692 pp.

Vol. XXIII, 1882. Bulletins of the United States National Museum: No. 11. Bibliography of the Fishes of the Pacific Coast of the United States to the end of 1879, by Theodore Gill. 76 pp. No. 12. Contributions to North American Ichthyology, by David Starr Jordan and Alembert W. Brayton. On the distribution of the Fishes of the Alleghany region, with a Synopsis of the family Catostomidæ. 240 pp. No. 13. The Flora of St. Croix and the Virgin Islands, by Baron H. F. A. Eggers. 136 pp. No. 14. Catalogue of the (Museum) Collection to Illustrate the Animal Resources and the Fisheries of the United States, prepared under the direction of G. Brown Goode. 352 pp. No. 16. Contributions to the Natural History of Arctic America, made in Connection with the Howgate Polar Expedition, 1877–'78, by Ludwig Kumlien, Naturalist of the Expedition. 180 pp.

Vol. XXIV, 1883. Bulletins of the United States National Museum, Vol. III. No. 16. Synopsis of the Fishes of North America, by David S. Jordan and Chas. H. Gilbert. 1,074 pp.

Vol. XXV, 1883. (See Vol. XX, above.) Bulletin of the Philosophical Society of Washington, Vol. IV, October, 1880, to June, 1881. 190 pp., with map of Bering strait. Vol. V, October, 1881, to December, 1882. 190 pp. Proceedings of the Biological Society of Washington, Vol. I, November, 1880, to May, 1882. 112 pp. Transactions of the Anthropological Society of Washington, Vol. I, February, 1879, to January, 1882. 144 pp. Abstract of Transactions of same society, March 4, 1879, to January 18, 1881, prepared by J. W. Powell. 150 pp.

Vol. XXVI, 1883. The Toner Lectures. Lecture VIII. Suggestions for the Sanitary Drainage of Washington City, by Geo. E. Waring, jr., of Newport, R. I. 24 pp. List of Foreign Correspondents of the Smithsonian Institution, corrected to January, 1882. 224 pp. Classification of the Coleoptera of North America, by John L. Le Conte and Geo. H. Horn. 608 pp.

Vol. XXVII, 1883. The Constants of Nature. Part IX. Atomic Weight Determinations: A Digest of the Investigations published since 1814, by Geo. F. Becker. 152 pp. The Constants of Nature. Part V. A Recalculation of the Atomic Weights, by Frank Wigglesworth Clarke, S. B. 296 pp. Check-list of the Publications of the Smithsonian Institution, December, 1881. 22 pp. Catalogue of Publications of the Smithsonian Institution, (1846–'82,) with an Alphabetical Index of Articles in the Smithsonian Contributions to Knowledge, Miscellaneous Collections, Annual Reports, Bulletins and Proceedings of the U. S. National Museum, and Report of the Bureau of Ethnology, by Wm. J. Rhees, chief clerk. 342 pp.

No. 480. Classified List of Publications of the Smithsonian Institution. 1883. 24 pp. Duplicate.

Vol. XXVIII, 1887. Tables, Meteorological and Physical, by Arnold Guyot, P. D., LL. D. Fourth edition, revised and enlarged. Edited by Wm. J. Libbey, jr. 776 pp.

Vol. XXIX, 1887. A Catalogue of Scientific and Technical Periodicals (1665 to 1882), together with Chronological Tables and a Library Check-list, by Henry Carrington Bolton.

Vol. XXX, 1887. Scientific Writings of Joseph Henry. Collected and arranged by S. F. Baird, Secretary of the Smithsonian Institution. Vol. I, 936 pp. Vol. II, 568 pp.

Vol. XXXI, 1888. Synoptical Flora of North America, by Asa Gray, LL. D. Vol. I, Part 2, The Gamopetalæ—Caprifoliaceæ to Compositæ, 488 pp. Vol. II, Part 1, Gamopetalæ after Compositæ, 500 pp.

Vol. XXXII, 1888. Article I. The Constants of Nature. Part I. A Table of Specific Gravities for Solids and Liquids. New edition, revised and enlarged. By Frank Wigglesworth Clarke. 420 pp. Article II. Index to the Literature of the Spectroscope, by Alfred Tuckerman. 436 pp.

Vol. XXXIII, 1888. (See Vol. XX and Vol. XXV, above.) Bulletin of the Philosophical Society of Washington. Vol. VI, for the year 1883, 220 pp. Vol. VII, for the year 1884, 194 pp. Vol. VIII, for the year 1885, 116 pp. Vol. IX, for the year 1886, 116 pp. Vol. X, for the year 1887, including a general index to volumes 1 to 10, 264 pp.

No. 663, 1888. Index to the Literature of Columbium: 1801-1887, by Frank W. Traphagen, Ph. D. 28 pp.

No. 694, 1885. The Toner Lectures: Lecture IX. Mental Overwork and Premature Disease among Public and Professional Men, by Chas. K. Mills, M. D. 34 pp.

No. 708, 1890. The Toner Lectures: Lecture X. A Clinical Study of the Skull, by Harrison Allen, M. D. 84 pp.

No. 741, 1890. Index to the Literature of Thermodynamics, by Alfred Tuckerman, Ph. D. 248 pp.

No. 764, 1890. The Correction of Sextants for Errors of Eccentricity and Graduation, by Joseph A. Rogers. 36 pp.

No. 785, 1891. Bibliograph of the Chemical Influence of Light, by Alfred Tuckerman, Ph. D. 24 pp.

Smithsonian Institution—Bureau of Ethnology, J. W. Powell, Director: Annual Reports of the Director, 21x29 cm., bound in olive-brown cloth. First Report, for the years 1879–'80, 640 pp., 570 figs., including a number of full-page cuts. Papers: On The Evolution of Language, Sketch of the Mythology of the North American Indians, Wyandot Government, and on Limitations to the Use of some Anthropologic Data, by J. W. Powell; A Study of the Mortuary Customs of the North American Indians, by H. C. Yarrow; Studies in Central American Picture Writing, by E. S. Holden; Cessions of Land by Indian Tribes to the United States, by C. C. Royce; Sign Language among North American Indians, by Col. Garrick Mallery; Catalogue of Linguistic Manuscripts in the Library of the Bureau of Ethnology, by J. C. Pilling; Illustration of the Method of Recording Sign Languages, by J. O. Dorsey, A. S. Gatschet, and S. R. Riggs.

Second Report, for the year 1880–'81, 520 pp., over 400 figs., and 77 plates, including a number of colored lithographs. Accompanying papers: Zuñi Fetiches, by F. H. Cushing; Myths of the Iroquois, by Erminnie A. Smith; Animal Carvings from the Mounds of the Mississippi Valley, by H. W. Henshaw; Navajo Silversmiths, by Washington Matthews, U. S. A.; Art in Shell of the Ancient Americans, by Wm. H. Holmes; Illustrated Catalogue of the Collections Obtained from the Indians of New Mexico and Arizona in 1879 and 1880, by James Stevenson.

Third Report, for 1881–'82, 680 pp., 44 pl., including several colored lithographs and 200 figures. Notes on Certain Maya and Mexican Manuscripts, by Cyrus Thomas; On Masks, Labrets, and certain Aboriginal Customs, by Wm. H. Dall; Omaha Sociology, by J. Owen Dorsey; Navajo Weavers, by Dr. Washington Matthews; Prehistoric Textile Fabrics of the United States, derived from Impressions on Pottery, by W. H. Holmes; Illustrated Catalogues of Collections made in 1881, by W. H. Holmes and James Stevenson.

Fourth Report, for 1882–'83, 596 pp., 83 plates, including a number of colored lithographs and 564 figures in text. Pictographs of the North American Indians, by Garrick Mallery; Pottery of the Ancient Pueblos, Ancient Pottery of the Mississippi Valley, and Origin and Development of Form and Ornament in Ceramic Art, by William H. Holmes; A Study of Pueblo Pottery, as illustrative of Zuñi culture growth, by Frank Hamilton Cushing.

Fifth Report, for 1883–'84, 620 pp.; 23 plates, including 4 double-page and 4 single-page colored lithographs of Indian dry-painting; 77 figs. in text; and 1 map, 75x80 cm., of former Cherokee country, in pocket. Burial Mounds of the northern sections of the United States, by Prof. Cyrus Thomas; The Cherokee Nation of Indians, giving the different treaties and a history of the nation from 1785 to 1868, by Chas. C. Royce; The Mountain Chant: a Navajo Ceremony, by Dr. Washington Matthews, U. S. A.; The Seminole Indians of Florida, by Clay MacCauley; The Religious Life of the Zuñi child, by Mrs Tilly E. Stevenson.

Sixth Report, for 1884–'85, 736 pp.; 10 plates, including a one-page map of Chiriqui, and two maps, 50x54 cm., of Eskimo countries in Arctic North America; 546 figures in text. Ancient Art of the Province of Chiriqui, and a Study of the Textile Art in its relation to the Development of Form and Ornament, by W. H. Holmes; Aids to the Study of the Maya Codices, by Cyrus Thomas; Osage Traditions, by Rev. J. Owen Dorsey; The Central Eskimo, by Dr. Franz Boas.

Seventh Annual Report, for 1885–'86, 452 pp., 27 plates (several colored), 39 figures in text. Indian Linguistic Families of America North of Mexico, by J. W. Powell; The Mide'wiwin or "Grand Medicine Society" of the Ojibwa, by W. J. Hoffman; The Sacred Formulas of the Cherokees, by James Mooney.

Bulletins: Catalogue of Prehistoric Works East of the Rocky Mountains, by Cyrus Thomas 1891. 248 pp., 17 plates, consisting of two-page maps of various sections, and one larger map of the eastern United States, folded.

Omaha and Ponka Letters, by James Owen Dorsey. 1891. 128 pp.

Bibliography of the Algonquian Languages, by James Constantine Pilling. 1891. 624 pp., 82 fac-similes of title-pages of the publications of the early missionaries among the Indians.

Bibliography of the Athapascan Languages, by James Constantine Pilling. 1892. 136 pp.

Smithsonian Institution—United States National Museum, G. Brown Goode, Assistant Secretary and Director: Bulletins—

No. 39, Part A. Directions for collecting birds, by Robert Ridgway, Curator of the Department of Birds. 1891. 28 pp., 9 figs.

Part D. Directions for collecting, preparing and preserving birds' eggs and nests, by Charles Bendire, Curator of the Department of Oölogy. 1891. 10 pp.

Part C. Notes on the preparation of rough skeletons, by Frederic A. Lucas, Assistant Curator of the Department of Comparative Anatomy. 1891. 10 pp., 12 figs.

Part E. Directions for collecting reptiles and batrachians, by Leonhard Stejneger, Curator of the Department of Reptiles and Batrachians. 1891. 13 pp., 4 figs.

Part B. Directions for collecting recent and fossil plants, by F. H. Knowlton, Assistant Curator of the Department of Botany. 1891. 46 pp., 10 figs.

Part F. Directions for collecting and preserving insects, by C. V. Riley, Curator of the Department of Insects. 1892. 152 pp., 1 pl., 139 figs.

Part G. Instructions for collecting mollusks, and other useful hints for the conchologist, by Wm. H. Dall, Curator of the Department of Mollusks. 1892. 56 pp.

No. 40. Bibliographies of American Naturalists: IV. The Published Writings of George Newbold Lawrence, 1844–'91, by L. S. Foster. 1892. 140 pp., with portrait.

No. 41. Bibliographies of American Naturalists: V. The Published Writings of Dr. Chas. Girard, by G. Brown Goode. 1891. 152 pp., with portrait.

No. 42. A Preliminary Descriptive Catalogue of the Systematic Collections in Economic Geology and Metallurgy in the United States National Museum, by Frederic P. Dewey. 1891. 276 pp., 34 pl.

Report of the United States National Museum, for the year 1884, 468 pp., bound, contains, besides the reports of the director and the curators of the following departments and sections: Materia Medica, by Dr. H. G. Beyer; Textile Industries, by Romyn Hitchcock; Naval Architecture, by J. W. Collins; Ethnology, by Dr. O. T. Mason; American Aboriginal Pottery, by Wm. H. Holmes; Antiquities, by Dr. Charles Rau; Mammals, by Frederick W. True; Birds, by Robert Ridgway; Reptiles and Batrachians, by Dr. H. C. Yarrow; Fishes, by Dr. Tarleton H. Bean; Mollusks, by Wm. H. Dall; Insects, by Dr. C. V. Riley; Marine Invertebrates, by Richard Rathbun; Paleozoic Invertebrate Fossils, by C. D. Walcott; Mesocenozoic Fossils, by Dr. C. A. White; Fossil Plants, by Lester F. Ward; Mineralogy, by Prof. F. W. Clarke; Lithology and Physical Geography, by George P. Merrill; and Metallurgy and Economical Geology, by Fred. P. Dewey; the following scientific papers: I. Throwing-sticks in the National Museum, by Otis T. Mason. Pp. 279–289, 17 pl. II. Basket Work of the North American Aborigines, by Otis T. Mason. Pp. 291–306, 64 pl. III. A Study of the Eskimo Bows in the United States National Museum, by John Murdock. Pp. 307–316, 12 pl. IV. On a Spotted Dolphin Apparently Identical with the Prodelphinus doris of Gray, by Frederick W. True. Pp. 317–324, 6 pl. V. The Florida Muskrat (*Neofiber alleni* True), by F. W. True. Pp. 325–330, 3 pl. VI. On the West Indian Seal (*Monachus tropicalis* Gray), by F. W. True and F. A. Lucas. Pp. 331–335, 3 pl. Also Bibliography of the United States National Museum for 1884: Part I, Publications of the Museum; Part II, Publications by officers of the Museum; Part III, Publications by investigators not officers of the Museum, based on Museum material. Finally, a list of accessions to the Museum during 1884.

Report of the U. S. National Museum for the year 1886. 856 pp. Contains the following subjects: Part I. Report of the Assistant Secretary of the Smithsonian Institution, in charge of the Museum. Part II. Reports of the curators of the following departments: Ethnology; American Aboriginal Pottery; Archæology; Food and Textiles; Steam Transportation, by J. Elfreth Watkins; Materia Medica; Mammals; Birds; Birds' Eggs; Reptiles and Batrachians; Fishes; Mollusks, including Cenozoic Invertebrate Fossils; Insects; Marine Invertebrates; Comparative Anatomy; Paleozoic Invertebrate Fossils; Mesozoic Invertebrate Fossils; Fossil Plants; Recent Plants; Minerals; Lithology and Physical Geology; Metallurgy and Economic Geology. Part III. Reports upon special collections in the National Museum, and papers illustrative of the collections. I. The Meteorite Collection: A Catalogue of Meteorites represented November 1, 1886, by F. W. Clarke. Pp. 255–265, I pl. II. The Gem Collection, by Geo. F. Kunz. Pp. 267–275. III. The Collection of Building and Ornamental Stones: a hand-book and catalogue, by Geo. P. Merrill, curator department of Lithology and Physical Geology. Pp. 277–648, 11 plates, 11 cuts. IV and V. The Collection of Textile Fibers and Fabrics in the National Museum, and the Preparation of Microscopical Mounts of Vegetable Textile Fibers, by Romyn Hitchcock. Pp. 649–658. VI. Instructions for Collecting Mammal Skins for Purposes of Study or for Mounting, by Wm. T. Hornaday, chief taxidermist U. S. National Museum. Pp. 659–670, 9 figs. Part IV. Bibliography of the U. S. National Museum during the year ending June 30, 1886. I. Publications of the Museum. II. Publications by officers of the Museum and other investigators whose writings are based on Museum material. Part V. List of accessions during the year ending June 30, 1886.

Report of the United States National Museum for 1887, 792 pp. Section I. Report of the Assistant Secretary in charge of the National Museum. Sec. II. Reports of the Curators of the following departments: Ethnology; American Aboriginal Pottery; Transportation; Archæology; Mammals; Birds; Birds' Eggs; Reptiles and Batrachians; Fishes; Mollusks, including Cenozoic Invertebrate Fossils; Insects; Marine Invertebrates; Comparative Anatomy; Paleozoic and Mesozoic Invertebrate Fossils; Fossil Plants; Recent Plants; Minerals; Lithology and Physical Geology; Metallurgy and Economic Geology. Sec. III. Papers illustrative of the collections in the United States National Museum: I. Cradles of the American Aborigines, by Otis T. Mason. Pp. 161–212, 44 figs. 2. Notes on the Artificial Deformation of Children among Savage and Civilized Peoples, by Dr. J. H. Porter. Pp. 213–235. 3. The Human Beast of Burden, by Otis T. Mason. Pp. 237–295, 54 figs. 4. Ethno-conchology: A Study of Primitive Money, by Robert E. C. Stearns. Pp. 295–334, 22 figs., 9 pl. 5. A Preliminary Catalogue of the Eskimo Collection in the United States National Museum, by Lieut. T. Dix Bolles, U. S. N. Pp. 335–365. 6. The Extermination of the American Bison, with a sketch of its discovery and life history, by William T. Hornaday. Pp. 367–548, 21 pl., 1 map of North America, 45x60 cm., showing the regions occupied by buffalo at different dates. 7. The Preservation of Museum Specimens from Insects and the Effects of Dampness, by Walter Hough. Pp. 549–558. Sec. IV. Bibliography of the Museum. Sec. V. List of Accessions.

Report of the National Museum for 1889, 902 pp., 108 pl., 137 figures, 7 maps. Section I. Report of the Director. Sec. II. Reports of the Curators (same as other books, with addition of Department of Botany, Dr. Geo. Vasey, Curator, and Department of Living Animals, Mr. Wm. T. Hornaday, Curator). Sec. III. Papers describing and illustrating the collections in the U. S. National Museum: I. The Museums of the Future, by G. Brown Goode. Pp. 427–445. II. Te Pito te Henua, or Easter Island, its Ethnology and Antiquities, by Wm. J. Thomson, Paymaster U. S. N. Pp. 447–552; pl. 12–60; figs. 1–20. III. Aboriginal Skin Dressing; a Study Based on the Material in the National Museum, by Otis T. Mason. Pp. 553–590; pl. 61–93. IV. The Puma, or American Lion (*Felis concolor* L.), by F. W. True. Pp. 591–608; pl. 94. V. Animals Recently Extinct, or Threatened with Extermination, by F. A. Lucas. Pp. 609–650; pl. 95–105; figs. 21, 22; maps 1–7. VI. The Development of the American Rail and Track, by J. Elfreth Watkins. Pp. 651–708; figs. 23–137. VII. Explorations in Newfoundland and Labrador in 1887, made in Connection with the U. S. Fish Commission Schooner "Grampus," by Frederick A. Lucas. Pp. 709–728; pl. 106. VIII. On a Bronze Buddha in the U. S. National Museum, by Charles De Kay. Pp. 729–735; pl. 107. Sec. IV. Bibliography of the U. S. National Museum. Sec. V. List of Accessions for the year ending June 30, 1889. Appended to this Report is Appendix E, a preliminary handbook of the Department of Geology in the U. S. National Museum, by Geo. P. Merrill, Curator; and included in the Report of the Assistant Secretary is Appendix D, a list of institutions and foreign and domestic libraries to which it is desired to send future publications of the National Museum. (This list contains the Kansas Academy of Science and 15 other libraries in Kansas.) 88 pp.

Report of the U. S. National Museum, for the year ending June 30, 1890. 852 pp., 163 pl., 99 figs. Section I. Report of the Assistant Secretary in charge of the Museum, pp. 1–116. Sec. II. Reports of the Curators, pp. 119–249. Sec. III. I. The Humming Birds, by Robert Ridgway. Pp. 253–383; pl. 1 to 46; figs. 1–47. II. White-line engraving for relief printing in the 15th and 16th centuries. Dotted prints, "gravures en manière criblée" (Fr.), "Schrotblatter" (Ger.), by S. R. Koehler, Curator of Graphic Arts. Pp. 385–394; pl. 47–50; figs. 48–50. III. The Methods of Fire-making, by Walter Hough. Pp. 395–409; pl. 51; figs. 51–63. IV. The Ula, or Woman's Knife of the Eskimo, by Otis T. Mason. Pp. 411–416; pl. 52–72, of 75 figs. V and VI. The Ancient Pit-dwellers of Yezo, and the Ainos of Yezo, Japan, by Romyn Hitchcock. Pp. 417–502; pl. 73–117; figs. 64–88. VII. Handbook of the Department of Geology in the U. S. National Museum. Part I. Geognosy: The Materials of the Earth's Crust, by Geo. P. Merrill. Pp. 503–591; pl. 108–129; figs. 89–98. VIII. The Catlin Collection of Indian Paintings, by Dr. Washington Matthews, U. S. A. Pp. 593–610; pl. 130–140. IX. The Log of the Savannah (the first steamship—American—to cross the Atlantic), by J. Elfreth Watkins. Pp. 611–639; pl. 101–156. X. Anthropology at the Paris Exposition in 1889, by Thomas Wilson. Pp. 641–680; pl. 157–163; fig. 99. Sec. IV. Bibliography. Sec. V. List of Accessions, pp. 719–788.

Proceedings of the U. S. National Museum, Vol. XIV, 1891, 750 pp., 34 pl. A Catalogue of the Fresh-water Fishes of South America, by Carl H. Eigenmann and Rosa S. Eigenmann. Pp. 1–81. A Collection of Fishes from Guaymas, by Barton W. Evermann and Oliver P. Jenkins. Pp. 121–165; pl. I, 2. Revision of Mamestra, by John B. Smith, Professor of Entomology, Rutgers College. Pp. 197–276; pl. 8–11. Annelida Polychaeta of Beaufort, N. C., by E. A. Andrews, Ph. D. Pp. 277–302; pl. 12–18. The Genus Panopeus, by James E. Benedict and Mary J. Rathbun. Pp. 355–385; pl. 19–24. Birds of Arctic America, by R. MacFarlane, F. R. G. S. Pp. 413–446. New Fishes from the Pacific Coast, by Charles H. Gilbert. Pp. 539–566. Biology of Chalcididae, by L. O. Howard. Pp. 567–588. A Review of the Snakes of North America, by E. D. Cope. Pp. 589–694. The Tetraodontoidea, by Theodore Gill. Pp. 705–720; pl. 34. And other shorter articles.

United States Department of Agriculture—Division of Botany: Bulletins—

No. 3. Grasses of the South: A report on certain grasses and forage plants for cultivation in the South and Southwest, by Dr. George Vasey, Botanist. 1887. 64 pp., 16 pl.

No. 6. Grasses of the Arid Districts: Report of an investigation of the grasses of the arid districts of Texas, New Mexico, Arizona, Nevada, and Utah, in 1887, by Geo. Vasey, Botanist. 1888. 60 pp., 30 pl.

No. 8. Grass Experiment Stations, Notes on Grasses, Botanical Notes, and the Genus Panicum in the United States, by Dr. George Vasey, Botanist. 1889. 39 pages, 64 species of Panicum, with descriptions.

Special Bulletin. The Agricultural Grasses and Forage Plants of the United States, and such foreign kinds as have been introduced, by Dr. Geo. Vasey, Botanist. 114 pp., 114 pll., with an appendix of 30 pages on the Chemical Composition of American Grasses, by Clifford Richardson, formerly assistant chemist. 1889.

Special Bulletin. Grass and Forage Experiment Station at Garden City, Kans., by Dr. J. A. Sewall, Superintendent. Coöperative Branch Stations in the South, by S. M. Tracy. 1892. 12 pp.

No. 12. Grasses of the Southwest: Plates and descriptions of the grasses of the desert region of Western Texas, New Mexico, Arizona, and Southern California, by Dr. George Vasey, Botanist U. S. Department of Agriculture. 19x29 cm. Part I, issued October 13, 1890, 50 plates and descriptions, one description to a page, facing the plate. Part II, issued December, 1891, 50 plates and descriptions.

No. 13. Grasses of the Pacific Slope: Plates and descriptions of the grasses of California, Oregon, Washington, and the northwestern coast, including Alaska, by Dr. Geo. Vasey, Botanist U. S. Department of Agriculture. 19x29 cm. Part I, issued October 20, 1892, 50 plates and descriptions, one description to a page, facing the plate.

No. 14. Ilex Cassine, the Aboriginal North American Tea: Its history, distribution and use among the native North American Indians, by E. M. Hale, M. D. 1891. 22 pp., 1 pl.

Contributions from the U. S. National Herbarium, Vol. I, No. 1, issued June 13, 1890. I. List of Plants collected by Dr. Edward Palmer in 1888, in Southern California. By Dr. Geo. Vasey and J. N. Rose. II. List of Plants collected by Dr. Edward Palmer in 1889, at 1, Lagoon Head; 2, Cedros Island; 3, San Benito Island; 4, Guadalupe Island; 5, Head of the Gulf of California. By Geo. Vasey and J. N. Rose. Pp. 1–28.

No. 2, issued June 28, 1890. Upon a collection of plants made by Mr. G. C. Nealley, in the region of the Rio Grande, in Texas, from Brazos Santiago to El Paso county. By John M. Coulter. Pp. 29–62.

No. 3, issued November 1, 1890. List of Plants collected by Dr. Edward Palmer in 1890, in Lower California and Western New Mexico, at 1, La Paz; 2, San Pedro Martin Island; 3, Raza Island; 4, Santa Rosalia and Santa Agueda; 5, Guaymas. By Geo. Vasey and J. N. Rose. Pp. 63–90, pl. 1.

No. 4, issued June 30, 1891. List of Plants collected by Dr. Edward Palmer in 1890, in Western New Mexico and Arizona, at 1, Alamos; 2, Arizona. By J. N. Rose, assistant botanist. Pp. 91–128, pl. 2–11.

No. 5, issued September 20, 1892. List of Plants collected by Dr. Edward Palmer in 1890, on Carmen Island. By J. N. Rose. List of Plants collected by the U. S. S. "Albatross," in 1887–'91, along the western coast of America. By J. N. Rose, D. C. Eaton, J. W. Eckfeldt, and A. W. Evans. Revision of the North American species of Hoffmannseggia, by E. M. Fisher. Systematic and Alphabetic Index of new species of North American Phanerogams and Pteridophytes, published in 1891. By Josephine A. Clark. Pp. 129–188, pl. 12–16.

Vol. II. Manual of the Phanerogams and Pteridophytes of Western Texas, by John M. Coulter. No. 1, issued June 27, 1891. Polypetalæ. Pp. 1–152, pl. 1. No. 2, issued June 1, 1892. Gamopetalæ. Pp. 153–346, pl. 2, 3.

Vol. III, No. 1, issued February 25, 1892. Monograph of the Grasses of the United States and British America, by Dr. Geo. Vasey, Botanist Department of Agriculture. Pp. 1–88.

Report of the Botanist for the year 1886, by Dr. Geo. Vasey. Native Clovers; Weeds of Agriculture, etc. Pp. 69–93; pll. 1–21. From Ann. Rep. Dept. Agr., 1886.

Report of the Botanist for the year 1888, by Dr. Geo. Vasey. Grasses and Weeds; The Pastoral Resources of Montana, by F. W. Anderson. Pp. 305–324; pll. 1–13. From Ann. Rep. Dept. Agr., 1888.

Report of the Botanist for the year 1889, by Dr. Geo. Vasey. Experiment Grass Station at Garden City, Kans.; Noxious Weeds, by F. V. Coville. Pp. 377–396; pll. 1–11. From Ann. Rep. Dept. Agr., 1889.

Report of the Botanist for the year 1890, by Dr. Geo. Vasey. Mississippi Experiment Station, by S. M. Tracy; Experiment Station at Garden City, Kans.; Grasses for Arid Districts; Noxious Weeds, by F. V. Coville. Pp. 375–392; pll. 1–8. From Ann. Rep. Dept. Agr., 1890.

U. S. Department of Agriculture—Division of Entomology, C. V. Riley, Entomologist: Bulletins—

No. 4. Reports of Observations and Experiments in the Practical Work of the Division, made under the direction of the Entomologist, 1884: Report upon Cranberry and Hop Insects, by John B. Smith. 42 pp. Observations on the Rocky Mountain Locust during the summer of 1883, by Lawrence Bruner. 12 pp. Preliminary report of observations upon insects injurious to cotton, orange, and sugar cane, by John C. Branner. 7 pp. Report on the effects of cold upon the scale insects of the orange in Florida, by Joseph Voyle. 4 pp. Correspondence, 24 pp.

No. 5. Descriptions of North American Chalcididæ, with biographical notes, together with a list of the described North American species of the family, by L. O. Howard, M. Sc., Assistant. 1885. 48 pp.

No. 6. The Imported Elm Leaf-beetle: its habits and natural history, and means of counteracting its injuries, by C. V. Riley. Second edition, 1891. 21 pp.; 1 pl.

No. 7. The Pediculi and Mallophaga affecting man and the lower animals, by Prof. Herbert Osborn. 1891. 56 pp., 42 figs.

No. 9. The Mulberry Silk-worm: being a manual of instructions in Silk-culture, by C. V. Riley, M. A., Ph. D. 1886, sixth edition, revised. 66 pp.; 2 pl.; 30 figs.

No. 10. Our Shade Trees and Insect Defoliators; being a consideration of four of the principal leaf-eaters, with means of destroying them, by C. V. Riley. 75 pp., 27 figs.

No. 11. Reports of Experiments with various insecticide substances, chiefly insects affecting garden crops, made under direction of the Entomologist. 1886. 34 pp. Experiments at Ames, Iowa, by Prof. Herbert Osborn. Experiments at Trenton, N. J., by Thomas Bennett. Experiments at Lafayette, Ind., by F. M. Webster.

No. 12. Miscellaneous Notes on the work of the Division of Entomology for the season of 1885, prepared by the Entomologist. 1886. 46 pp.; 1 pl. On the production and manufacture of buhach, by D. W. Coquillett. Causes of the destruction of the evergreen and other forest trees in Northern New England, by A. S. Packard. The periodical cicada in Southeastern Indiana, by A. W. Butler.

No. 13. Reports of Observations and Experiments in the Practical work of the Division, made under the direction of the Entomologist. 1887. 80 pp. Report on Locusts in Texas during the spring of 1886, and report on Nebraska insects, by Lawrence Bruner. Report on Insects injurious to forest and shade trees, by Dr. A. S. Packard. Report on Ohio insects and tests with insecticides, by William B. Alwood. Notes from Missouri, by Mary E. Murtfeldt. Agricultural Experiments, by Nelson W. McLain.

No. 14. Same title. 1887. 62 pp., 4 figs. Report on Insects injurious to garden crops in Florida, by Wm. H. Ashmead. Report on buffalo gnats, by F. M. Webster. Native Plums, how to fruit them, by D. B. Wier, Lacon, Ill. The Serrell automatic silk reel, by Philip Walker.

No. 16. The Entomological Writings of Dr. Alpheus Spring Packard, by Samuel Henshaw. 1887. 48 pp.

No. 19. An Enumeration of the published Synopses, Catalogues and Lists of North American Insects, together with information intended to assist the student of American entomology. 1888. 78 pp.

No. 20. The Root-knot Disease of the peach, orange and other plants in Florida, due to the work of Anguillula, prepared under direction of the Entomologist, by J. C. Neal, Ph. D., M. D. 1889. 32 pp., 21 pll., colored.

No. 21. Report of a Trip to Australia, made under the direction of the Entomologist, to investigate the natural enemies of the fluted scale, by Albert Koebele. 1890. 32 pp., 16 figs.

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No. 25. Destructive Locusts: A popular consideration of the more injurious "grasshoppers" of the United States, together with the best means of destroying them, by C. V. Riley, Entomologist. 1891. 62 pp.; 11 figs.; 12 pll.; 1 map.

No. 26. Reports of Observations and Experiments in the practical work of the Division, made under the direction of the Entomologist. 1892. 96 pp. Report upon insect depredations in Nebraska, by Lawrence Bruner. On the scale insects of California, by D. W. Coquillett. Notes for the season of 1891, by Mary E. Murtfeldt. On the investigation of the cotton-boll worm, by F. W. Mally. Insects of the season in Iowa, by Herbert Osborn. Entomological work of the season of 1891, by F. M. Webster. The gypsy-moth in Massachusetts, by Samuel Henshaw. Agricultural experiments in 1891, by A. J. Cook.

Insect Life: A monthly periodical bulletin, devoted to the economy and life habits of insects, especially in their relations to agriculture. Edited by C. V. Riley, Entomologist, and L. O. Howard, First Assistant, with the assistance of other members of the divisional force. Vol. III, No. 3, November, 1890, to No. 12, August, 1891. Pp. 89 to 520; figs. 6-35. Vol. IV, 1891-'92, complete. 452 pp.; 77 figs. Vol. V, No. 1, September, 1892. 64 pp.; 6 figs.

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No. 1. Report on the Relation of Railroads to Forest Supplies and Forestry, together with Appendices on the structure of some timber ties, their behavior, and the cause of their decay in the roadbed; on wood preservation; on metal ties; and on the use of spark arresters. Compiled by the Chief of the Forestry Division. 1887. 150 pp., 20 plates, photomicrographs of various woods.

No. 2. Report on the Forest Conditions of the Rocky Mountains, and other papers, with a map showing the location of forest areas on the Rocky Mountain range. Second edition, 1889. 252 pp., map 50x81 cm. The Government in its Relation to Forests, by Prof. E. J. James. 18 pp. Report on the Forest Conditions of the Rocky Mountains, by Col. Edgar T. Ensign. 111 pp. and map. Forest Flora of the Rocky Mountains, by George B. Sudworth. 45 pp. Report on the

Forests of Los Angeles, San Bernardino and San Diego counties, and Trees and Shrubs of San Diego county, Cal., by Abbott Kinney. The Needs of the Yellowstone National Park, by Arnold Hague. Summary of Legislation for the preservation of timber or forests on the public domain, by N. H. Egleston. The Climate of Colorado, and its effects upon trees, by George H. Parsons. Snow-slides, or Avalanches, their formation and prevention, by B. E. Fernow.

No. 5. What is Forestry? by B. E. Fernow, Chief. 1891. 52 pp.

No. 6. Timber Physics. 24x30 cm. Part I, Preliminary Report. Compiled by B. E. Fernow, Chief. 1892. 62 pp., 4 plates. Scope and historical development of the science of "Timber Physics." Organization and methods of the timber examination in the Division of Forestry.

U. S. Department of Agriculture — Division of Ornithology and Mammalogy, Dr. C. Hart Merriam, Ornithologist:

Bulletin No. 1. The English Sparrow (*Passer domesticus*) in North America, especially in its relations to agriculture. Prepared under the direction of Dr. C. Hart Merriam, Ornithologist, by Walter B. Barrows, Assistant. 1889. 408 pp.; 1 pl.; 1 map of the United States, showing the distribution of the English sparrow.

North American Fauna. A serial. No. 1, October 25, 1889. Revision of the North American Pocket Mice, by Dr. C. Hart Merriam. 30 pp.; 4 plates.

No. 2, October 30, 1889. Descriptions of fourteen new species and one new genus of North American Mammals, by Dr. C. Hart Merriam. 36 pp., 8 plates.

No. 3, September 11, 1890. Results of a Biological Survey of the San Francisco Mountain region and Desert of the Little Colorado, Arizona. 1, General Results, with special reference to the geographical and vertical distribution of species; 2, Grand Cañon of the Colorado; 3, Annotated List of Mammals, with descriptions of 7 new species; 4, Annotated List of Birds; by Dr. C. Hart Merriam. 5, Annotated List of Reptiles and Batrachians, with descriptions of new species; by Dr. Leonhard Stejneger. 6, The Forest Trees of San Francisco Mountain region, by Dr. C. Hart Merriam. 136 pages; 2 figures in text; 12 plates; 6 biological colored maps.

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—— *Division of Microscopy, Thomas Taylor, M. D., Microscopist:* Report of the Microscopist for the year 1889, by Thomas Taylor. Pp. 191–200; 13 colored lithograph plates, 8 on tea leaves, 5 tests of olive oils. From Ann. Rep. Dept. Agr., 1889.

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—— *Division of Mycology, F. Lamson-Scribner in charge:* Report of the Mycologist for the year 1886, by F. Lamson-Scribner. Pp. 95–138; pl. 1–8; map. Downy Mildew, Powdery Mildew, Black-rot; Anthracnose, etc.

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Bulletin No. 1. Additional Evidence on the Communicability of Peach Yellows and Peach Rosette, by Erwin F. Smith, Special Agent. 56 pp.; 42 phototypic plates.

A Disease of Almond Trees, by Newton B. Pierce. Suggestions in regard to the Treatment of Cercospora circumscissa, by B. T. Galloway. Pp. 65–78; pl. 11–14. From Journal of Mycology, Vol. II, No. 2.

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Vol. VI. The Thegiha Language, by James Owen Dorsey. 1890. 824 pp. Parts I and II. Myths, Stories, and Letters.

Vol. VII. A Dakota-English Dictionary, by Stephen Return Riggs. Edited by James Owen Dorsey. 1890. 676 pp.

United States Department of the Interior — United States Geological Survey, J. W. Powell, Director: Annual Reports, 22x29 cm., bound in brown cloth, vignette. Tenth Annual Report: Part I, Geology. 792 pp.; 69 figs. in text; 98 pll.; map in pocket. Report of the Director and administrative reports, first 252 pp. General Account of the Fresh-water Morasses of the United States, with a description of the Dismal Swamp district of Virginia and North Carolina, by Nathaniel Southgate Shaler. Pp. 255–339; pll. 6–19; figs. 2–38. The Penokee Iron-bearing series of Michigan and Wisconsin, by Roland Duer Irving and Charles Richard Van Hise. Pp. 341–506; pll. 20–42; figs. 39–43. The Fauna of the Lower Cambrian or Olenellus Zone, by Chas. D. Walcott. Pp. 509–763; pll. 43–98; figs. 44–69*a-b*. Part II, Irrigation — First annual report. 132 pp.

Bulletins—No. 57. A Geological Reconnaissance in Southwestern Kansas, by Robert Hay. 1890. 49 pp.: 2 pl.

58. The Glacial Boundary in Western Pennsylvania, Ohio, Kentucky, Indiana, and Illinois, by George Frederick Wright, with an introductory by Thomas Chrowder Chamberlin. 1890. 112 pp., incl. 1 pl.: 8 pl.

59. The Gabbros and Associated Rocks in Delaware, by Frederick D. Chester. 1890. 45 pp.; 1 pl.

60. Report of work done in the Division of Chemistry and Physics, mainly during the fiscal year 1887–'88. F. W. Clarke, chief chemist. 1890. 174 pp.

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71. Index to the Known Fossil Insects of the World, including Myriapods and Arachnids, by Samuel Hubbard Scudder. 1891. 744 pp.

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75. Record of North American Geology for 1887 to 1889, inclusive, by Nelson Horatio Darton. 1891. 173 pp.

76. A Dictionary of Altitudes in the United States (second edition), compiled by Henry Gannett, chief topographer. 1891. 393 pp.

77. The Texan Permian and its Mesozoic Types of Fossils, by Charles A. White. 1891. 51 pp.; 4 pl.

78. A report of work done in the Division of Chemistry and Physics, mainly during the fiscal year 1889–'90. F. W. Clarke, chief chemist. 1891. 131 pp.

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82. Correlation papers—Cretaceous, by Charles A. White. 1891. 273 pp.; 3 pl., one a two-page colored map.

83. Correlation papers—Eocene, by William Bullock Clark. 1891. 173 pp.; 2 pl.

84. Correlation papers—Neocene, by W. H. Dall and G. D. Harris. 1891. 349 pp., 3 pl., all two-page colored maps.

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86. Correlation papers—Archean and Algonkian, by C. R. Van Hise. 1892. 550 pp.; 12 pl., all one- or two-page colored maps.

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United States Coast and Geodetic Survey: Report for 1888. 24x29 cm, bound in black cloth. 566 pp.; 60 folded maps, sketches, and illustrations. Contains the following principal papers in the appendices: No. 6. Part I. Value of the "Arcano del Mare" with reference to our knowledge of the magnetic declination in the earlier part of the 17th century. Pp. 167–170. Part II. Historical review of the work of the C. & G. Survey in connection with terrestrial magnetism. Pp. 171–176. No. 7. The secular variation of the magnetic declination in the United States at some foreign stations. Seventh edition. Pp. 177–312. No. 14. Determination of latitude and gravity for the Hawaiian government. Pp. 471–563.

Report for 1889. Same size and style. 506 pp.; 50 maps, sketches, and illustrations. Contatns the following papers: No. 7. The need of a remeasurement of the "Peruvian arc," by Erasmus D. Preston. Pp. 199–208. No. 11. The distribution of the magnetic declination in the United States for the epoch 1890, by Charles A. Schott. Pp. 233–402. No. 16. Gulf Stream explorations — observations of currents, 1888 and 1889, by Lieut. J. E. Pillsbury, U. S. N. Pp. 466–477.

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