the future they will play an important part. George Stuart Fullerton discusses 'Freedom and Free Will' and William Barclay Parsons treats of 'Chinese Commerce' the gist of which is a plea for what every sensible man knows should exist, a permanent consular service. There are interesting articles under the head of 'Discussion and Correspondence,' 'Scientific Literature' and 'The Progress of Science.'

*Bird Lore* for December comes in an enlarged form and has for its frontispiece a fine photograph from life of a rough-legged Hawk. E. R. Warren describes, with a number of illustrations, 'Photographing Ptarmigans' and this is followed by an article on 'How Ptarmigans Moult,' by Jonathan Dwight, Jr., the best authority on that vexed subject. Bradford Torrey writes of 'Winter Pensioners.' The department 'For Teachers and Students' is devoted, under the caption 'Birds and Seasons' to the first series of papers giving an outline course of bird-study for the year, the present dealing with the months of December and January and with various part of the country from Boston to San Francisco, each article being by a well known authority on the subject. The other and shorter articles under the different departments are too numerous for individual notice, but the Audubon Department is of particular interest.

## *SOCIETIES AND ACADEMIES.*

### NEW YORK ACADEMY OF SCIENCES.

### SECTION OF GEOLOGY AND MINERALOGY.

AT the meeting of the Section on October 15th, Dr. A. A. Julien in the chair, about thirty persons were present.

The Secretary of the Academy nominated for membership Riccardo Pattelli and Charles Lane Poor, and the names were referred to the Council.

The following notes on the results of the summer's work by members were presented:

Gilbert Van Ingen.—Paleozoic Faunas of Northwestern New Jersey.

Mr. van Ingen described the work of the party belonging to the Geological Survey of New Jersey, which, during the past two summers, has been engaged in tracing the outcrops of the paleozoic formations, and collecting fossils. Of this party, Mr. Kummel, the assistant State geologist, traces the boundaries and works out the tectonics, while Dr. Weller, of the University of Chicago, collects fossils at localities indicated by Mr. Kummel. During July, Mr. van Ingen spent a week with this party in the field at Newton. Newton is situated on the shales of the Trenton group, there extensively quarried for slates. To the east is a low ridge of limestone which presents the same appearance as the Barnegat limestone along the Hudson river. The upper part of this limestone has yielded trilobites, probably *Dikellocephalus*, indicating that this portion is of upper Cambrian age. At other localities a trilobite described by Weller as *Liostracus jerseyensis*, shows that the rock there is also Cambrian—probably of the middle or upper division. In the vicinity of Franklin Furnace good specimens of *Olenellus cf. thompsoni* were found at localities described by Foerste. Further to the east of Newton, on the other side of the Cambrian ridge, is a wide belt of Ordovician rocks—Trenton limestone overlaid by a thick series of shales. The limestone contains the typical Trenton fauna,—*Rafinesquina Plectambonites*, *Pterygometopus*, etc.,—and is very much like that found at Rosetown, Ulster Co., and Rochdale, Dutchess Co., N. Y. The shale has few fossiliferous beds, but occasionally one of the more sandy layers contains *Dalmanella testudinaria*, *Plectambonites* and *Rafinesquina*—the same combination found in the Hudson shales at Poughkeepsie and at Rondout. At one locality was found a fauna with *Ampyx* and *Harpes*. In eastern New York these genera of trilobites are found only in the Chazy limestone, and the discovery is of great interest in that it indicates the presence of this formation at a distance of almost 250 miles south of what has hitherto been recognized as its southern limit. Further to the northwest, along the Delaware river, were found the Silurian and lower Devonian formations. The finest section is seen in the face of the cliff of the old Nearpass quarry, about three miles south of Tri-States, where all the formations from the upper Ordovician to the Esopus shale of the lower Devonian appear, with numerous fossils. At Otisville the Shawangunk grit is finely exposed in a large quarry. All the evidence at hand

points to the conclusion that this formation, of a thickness of at least a thousand feet, was formed as a flood plain deposit. Its characteristics, except color, are the same as the New Jersey and Connecticut valley Jurassic sandstones. Ripple-marks, sun-cracks, cross-bedding, channel-fillings, etc., are abundant. In the railroad cut west of Otisville the grit lies upon Hudson shales, with non-coincident dip. On the contact occurs a few inches of clay, which next to the shale, is quite free of pebbles, while next the grit it is filled with quartz pebbles. This was interpreted to be residual clay caused by the decomposition of the shale, through sub-aërial agencies, before it became covered by the grit. The old notions regarding rock-formation required the presence of a body of water in which the sediments might be deposited. Several of the geological subdivisions showed characters which would not have been present had these formations been laid down under water, for this mode of origin results in a sorting of the rock-forming materials, and no sorting is detected in these grits. Flood plain deposits are very irregular, both as to stratification and sorting of materials, and these features are well exhibited in the grits. Other formations that are probably plain-flood deposits are parts of the Potsdam sandstone in eastern New York, the Medina sandstone, the sandstones of the Catskill group, and many of the sandstones of the coal measures of Pennsylvania and the Mississippi valley—in fact the greater part of the 'Barren Measures.'

Dr. Theodore G. White presented notes on 'The Glen Falls, N. Y., section of the Lower Ordovician,' described his detailed study of the faunas of successive strata at Glen Falls, and their relations to similar studies along the Lake Champlain valley to the north, and the Mohawk and the Black River valleys to the west. The section forms a low anticline along the shore of the Hudson. At the base is seen the Calciferous sandrock, containing *Ophileta* and fucoids. Conformable upon this is a layer a few inches thick, of barren black shale, which is very much crushed, and then the same beds of the ostracod, *Leperditia*, and their associated corals and peculiar forms of *Strophomena*, as have been found in the lowest Black River zones on Button Island in Lake Champlain. The zones of *Parastrophia* and *Triplesia*, occurring near this portion of the series in localities to the north and west, were not found here. The succeeding coral beds of *Columnaria* were well developed. Above these are the cross bedded gray beds, which in some recent reports have been considered to represent the Birdseye limestone, which seems to be lacking in this locality, unless met with at this unexpectedly high position. The upper portion of the section, which is of lower Trenton age, shows no unusual forms. The tendency of the lowest and the uppermost portions of the Ordovician sections in the region to wear away and appear wanting, owing to their prevailing softness, was commented on.

Dr. Henry S. Washington read a paper on 'The Rocks of Lake Winnipesaukee, N. H.,' as a preliminary report on work done by Professor Pirsson and himself on Mount Belknap and Red Hill, near Lake Winnepesaukee, N. H. The rocks of Mount Belknap are shown to be prominently a quite uniform alkali syenite, which is cut by many dikes of camptonite and allied rocks, and of bostonites, aplites and syenite-porphyries. These dikes also cut the surrounding porphyritic gneiss. At one place, near the border, is a mass of basic hornblende-gabbro, with large, poikilitic phenocrysts of brown hornblende. A syenite breccia also occurs. At Red Hill similar syenite, formerly described by W. S. Bayley, occurs on the summit, while, toward the periphery, nephaline appears as a constituent, and a true foyaite is developed. The massif is also cut by dikes, both camptonitic and syenitic. The region is to form the subject of a petrographic study by the two geologists in the near future.

Professor Daniel S. Martin described a visit which he paid during the summer to the noted mineral locality at Haddam, Maine. He described the manner in which the choicest specimens occur there, in veins of albitic pegamatite, with tourmaline, muscovite and quartz along the contact with the wall of gneiss. The mica plates along the contact are often two feet in diameter.

Dr. A. A. Julien in his paper 'The Geology of Central Cape Cod' reviewed the opinions of

Mitchell, Davis, Shaler and others on the geology of Cape Ann, with especial reference to the district from Chatham to Yarmouth. In the stratified deposits of sands and gravels which underlie the plains south of the morainal 'back-bone' of the Cape, the more frequent intercallation of clays was pointed out, and the occasional disturbance and flexure. Striated pebbles, although much water-worn, are quite largely interspersed. The discovery of true glacial silt at some depth in one locality indicates that the ice-sheet there rested, instead of floating. The kettle shaped hollows and pond-basins were shown by the speaker to be largely connected with the damming of surface streams, and some observations on the pre-glacial drainage valleys and topography were discussed. The identification of certain transported fragments of quartz-porphyry with outcrops of the same near Marblehead indicate a pre-glacial movement from N.N. W. to S.S. E. To the fifteen changes of level which have been recorded, a final small elevation probably should be added, judging from the low terrace along this part of the coast. Examples of the facited pebbles were exhibited and provoked considerable discussion among those present as to the origin of those pebbles.

Professor Richard E. Dodge recounted his pleasure in visiting the region of the Colorado Canyon, during the past summer, in company with a party, and finding the physiography, as graphically illustrated in the drawings in Powell's reports, to be a most faithful and non-diagrammatic portrayal of the features themselves. He then described the striking examples of gigantic geophysical results seen in the Great Kiabab anticline, the Grand Canyon itself, and the Kiabab plateau and its faults. He also described the appearance of the great basin of 'Lake Bonneville.'

Remarks on foreign localities visited by them during the summer, were made by Professor J. J. Stevenson and Dr. E. O. Hovey.

THEODORE G. WHITE,
*Secretary of Section.*

SECTION OF ANTHROPOLOGY AND PSYCHOLOGY.

THE regular meeting of the Section was held on November 26. The first paper was a report of the Paris Congress of Psychology by Dr. R. S. Woodworth. This report was more detailed than the published accounts and also suggested certain questions in regard to the enlargement and control of American representation at similar congresses in the future.

The second paper, by Mr. Clark Wissler, on 'Correlation of Anthropometric Tests,' reported some results of a series of mental and physical tests upon students in Columbia University and Barnard College. The young women of Barnard College were found to be superior to Columbia freshmen in the tests for time of perception, naming of colors and resistance to pressure; they were equal to the freshmen in rate of fatigue, perception of weights, sensation areas, perception of size and logical memory; they were inferior in size of head, strength of hand, reaction time, association time and auditory memory. There is some probability that the young women are superior in perception of pitch and inferior in movement time. With the freshmen who repeated the test in their senior year an improvement was found in all except sensation areas and perception of size, though the difference in some cases is slight. It was also found that the seniors showed a decided tendency to hold the same relative rank as when freshmen, thus indicating a general advancement of the group during college life. In correlations it appeared that logical memory and length of head are related characteristics, but length of head also correlates with lung capacity and strength of hand. The work has not gone far enough to say which of these has the most weight. Attempts to correlate reaction time and the other tests of quickness gave no results.

The third paper, presented by Dr. E. L. Thorndike, reported the results of certain experiments on the 'Effects of Special Training on General Ability.' These experiments were performed jointly by Drs. Woodward and Thorndike. The results of a number of experiments show that when any mental function is trained in connection with certain data, the improvement is not of the function in general. If different data are used there will be less or even no improvement shown. The general theory that the mind equals a number of special

abilities, independent to a degree hitherto unsuspected, was supported further by the great variability in our judgments of slightly differing magnitudes.

The fourth paper, by C. H. Judd was on the 'Movements of Writing.' These movements were analyzed by means of tracers attached to the hand, back of the fingers, and to the arm, back of the wrist. The written words give the sum of all the movements of arm, hand and fingers. The hand tracer gives only arm and hand movements, omitting finger movements. The arm tracer shows arm movements only. The general result of this analysis shows that the arm carries the hand forward and participates only to a very small degree in the formation of the letters and words. The gross movements, especially those which are upward and forward, in the formation of the letters, are performed by the hand. All the finer curves and more delicate lines of the letters are formed by the fingers. The muscular coordinations of the different individuals tested, while differing greatly in detail characteristics, all show this general type of movement. No results were presented from subjects who write naturally with a full arm movement.

Charles H. Judd,
*Secretary.*

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 524th annual meeting of the Society was held on Saturday night, November 24th, at the Cosmos Club.

Under the title of 'An Attempted Solution of the Social Problem,' Mr. B. Pickmann Mann described the organization and history of the People's Real Estate Tontine, a philanthropic institution incorporated under the laws of New York State as a building and loan association, with the purpose of providing an annual income of increasing value with increase of age, especially for the relief of superannuated persons from poverty. The officers and trustees of this Association serve gratuitously and it has been endowed by gifts from many persons. This account of the last eight years' growth of the Association supplemented an account of the first eight years' growth, given before the Society by Mr. Mann under the same title in 1892.

The second paper was by Mr. F. O. Radelfinger, whose topic was 'Divergent Series.' After some preliminary remarks on the origin of divergent series, in which he pointed out a distinction between those which rise naturally from investigation in mathematics and those which are simply hypothecated, he passed to the consideration of some recent investigations by Borel.*

A first power series, assumed to be either divergent or convergent was written down, and a second more convergent series obtained from this by multiplying each term by a uniformly decreasing factor $a^n/n!$ A relation between these two series was to be deduced, which relation was expressed as a definite integral of a function of the second or derived series and certain simple transcendentals. Some applications of this relation were then given and its use in rendering the first series convergent in extending its original domain of convergence was pointed out. The relations discovered by Steitjie between certain divergent series and continued fractions were stated and their extension by Borel mentioned.

E. D. Preston,
*Secretary.*

GEOLOGICAL SOCIETY OF WASHINGTON.

The 105th regular meeting was held November 28, 1900. The following papers were presented:

Mr. Arnold Hague, 'Account of the International Geological Congress at Paris, 1900.'

Mr. F. L. Ransome, 'The Fissure Systems of the Silverton Quadrangle, Colorado.'

The remarkably numerous and persistent fissures, in which occur most of the ore bodies of this portion of the San Juan Mountains, were described and classified. It was concluded that the forces which produced the fissuring were local in character and practically confined to the fissured area. They were probably genetically connected with the eruption and local accumulation of great thicknesses of volcanic rocks upon an ancient eroded basement.

F. L. Ransome,
David White,
*Secretaries.*

* *Annales de l'Ecole Normale*, 1899.

## BIOLOGICAL SOCIETY OF WASHINGTON.

THE 328th meeting was held on Saturday evening, November 17th, and was devoted to a popular symposium on the subject of 'Malaria from a Biological Standpoint.'

C. W. Stiles described 'The Structure and Life History of the Parasites of Malaria,' illustrating his remarks with numerous diagrams. He noted the various theories regarding malaria and pointed out the steps by which our present knowledge of its cause had been reached, stating that Dr. A. F. A. King was the first to suggest that the mosquito was the direct agent in transmitting the disease. The manner in which the parasite passed from the water to the mosquito and thence to man was described in some detail, and the fact brought forward that various animals are subject to malaria produced by different parasites than those which cause the malaria of man.

L. O. Howard discussed 'The Malarial Mosquitoes, their Biology, what has been done and what may be done to Exterminate Them,' giving a full description of the biology of *Anopheles*, contrasting it with the life history of *Culex* and with the recently discovered and as yet unpublished life history of *Psorophora*, illustrating his remarks with lantern slides. He dwelt at some length on the subject of mosquito control, describing the different remedies and mentioning some cases in which, during the past summer, not only had the mosquito supply been greatly diminished, but in one malarial village malaria had practically been eradicated. He also described at some length the results of a very interesting experiment in community work at Winchester, Va., where the treatment of mosquito breeding-places was made, during the past summer, a police measure.

F. A. LUCAS,
*Secretary.*

## ZOOLOGICAL JOURNAL CLUB OF THE UNIVERSITY OF MICHIGAN.

AT the meeting of November 15th, Mr. Raymond Pearl gave an account of work carried on at Woods Holl on the reactions of the embryos and larvæ of *Limulus*. The normal movements and reactions of the adult had been studied, and a brief prefatory account of these was given. With this as a basis, the question was investigated whether there occurs a *development of reactions* comparable with the structural development. The results showed a distinct parallelism in many respects between the morphological development on the one hand and the psycho-physiological development on the other.

The Walking Movements.—Some time before the animal leaves the egg shell (or more properly, the 'vicarious chorion') purposeless kicking movements of the legs appear. After hatching, these movements continue, but gradually become coordinated by practice, until the perfected walking movement is produced from them.

The Swimming Reflex. — The swimming movements of the larva in the tribolite stage and for a week following the moult which terminates that stage are different from those of the adult. The adult swims by a combined, coordinated movement of the thoracic and abdominal appendages. In the young larvæ swimming takes place by the action of the gills, the legs being held perfectly quiet, strongly extended over the anterior edge of the thorax. The gills of the larva beat rhythmically from the first in a perfectly coordinated way. This movement begins within an hour after the animal leaves the 'vicarious chorion'; it is clearly a reaction due to the stimulation produced by direct contact of sea water with the gills.

Normal respiratory movements begin some time before hatching. The complicated chewing reflex of the adult is absent in young larvæ. The burrowing habit arises as a modification of the thigmotactic response of the larva.

To mechanical stimulation there is but one response, and this is the same, whatever part of the body is stimulated.

The phototactic, geotactic, hydrotactic and general thigmotactic reactions were discussed.

All the reactions were found to be of a peculiarly definite machine-like character, as if each were the result of the starting into activity of a distinct mechanism by a stimulus. The reactions appear as soon as their mechanisms are developed. So long as the mechanism is intact the response always takes place in the same way. The reactions can be analyzed into

more or less simple, but distinct and specific, reflexes.

The fourth meeting was held November 22d. Dr. S. J. Holmes gave an account of some experiments on the development of fragments of the egg of *Pennaria*.

Mr. Raymond Pearl presented the results of a study of the motor reactions of the ctenophore *Mnemiopsis leidyi*.

Attention was directed especially to the question of how the organism moves with reference to the position of external objects acting as stimuli. To localized mechanical stimuli two distinct motor reactions were found to occur, depending on what part of the body was stimulated. (1) Stimulation in the region about the aboral pole caused an increase in the strength of the beat of the comb-rows, resulting in a movement of the animal straight ahead (toward the oral end): therefore *away* from the source of stimulation. (2) Stimulation of any other region of the body causes the following reaction: (*a*) the lobes close strongly, thus expelling the water rapidly and causing the animal to move backward (toward the aboral end). At the same time the comb-rows cease to beat. (*b*) The comb-rows on the side stimulated remaining partly or entirely quiet, the other comb-rows begin to beat strongly, carrying the animal forward and at the same time of course usually turning it *toward* the source of stimulus (never toward the opposite side). As the animal thus moves toward the source of stimulus the lobes are opened widely and the tentacles thrown back. This movement frequently brings the mouth of the animal against the stimulating agent, if the latter remains in place. This response is perhaps a *food reaction*. (This account is of a perfectly typical case, from which there are individual variations.)

Experiments were made on the relation of the central nervous system to the coordination exhibited in the contraction of the lobes. It was found that in animals from which the whole aboral end had been removed, including the whole of the central nervous system, there was still perfect coordination in the contraction of the lobes of the two sides. When a single lobe was removed from the body and split lengthwise so that the two parts remained connected only by a small bridge of tissue, the contraction of the two longitudinal halves was still found to be well coordinated.

H. S. Jennings,
*Secretary*.

## Science Club of the University of Wisconsin.

The Science Club of the University of Wisconsin held its first meeting of the academic year on the evening of November 27th. Dr. E. A. Birge, the new president of the Club and the acting president of the University, delivered an address upon 'Huxley.' Because of the very general interest of this address, the meeting was an open one and the large lecture hall of the University was crowded. Dr. Birge analyzed the qualities of mind and heart which characterized the great expositor of the doctrine of evolution. An interesting contrast was instituted between Huxley upon the one hand and first Matthew Arnold and then Gladstone upon the other.

While warmly sympathetic and eulogistic to a high degree, Dr. Birge's estimate of Huxley was in essential agreement with that of Gladstone, whose judgment was that however great Huxley's talents, he was not a genius.

Wm. H. Hobbs.

## The Academy of Science of St. Louis.

At the meeting of the Academy of Science of St. Louis on the evening of November 19th, Mr. C. F. Baker exhibited a large amount of living and preserved material, including microscopic preparations, illustrative of American Isopods and Amphipods, accompanying the demonstration by a short *résumé* of the work thus far done on Crustaceæ, particularly on these two groups, and making some interestingly suggestive remarks on the peculiar affinities of a number of the species found in deep wells or hot springs.

Dr. Amand Ravold presented an abstract of the results reached in some recent bacteriological examinations of water from the Illinois, Mississippi and Missouri rivers, particularly concerning certain features of the occurrence and abundance of *Bacillus coli-communis*.

One person was elected to active membership.

WILLIAM TRELEASE,
*Recording Secretary.*

## *DISCUSSION AND CORRESPONDENCE.*

### VON IHERING'S ARCHIPLATA–ARCHELEMIS THEORY.

IN SCIENCE for December 7th, Dr. H. von Ihering gives a condensed statement of his views on the origin of the South American fauna. This is the more welcome, since the original publications of v. Ihering, although dating back to 1890, are not very well known, chiefly because these articles (of which v. Ihering gives a list) have been published in periodicals, in which hardly anybody would look for them. Part of them are of a mere popular character, while another part are too much out of the way, and they do not, by their titles, give any indication that we might look in them for a discussion of zoogeographical topics of general interest.

As regards the chief idea of v. Ihering, that South America consists, genetically, of two different parts, *Archiplata* and *Archamazonas*, which have become united subsequently, I am of the opinion that this theory is well worth discussion. Indeed, I have accepted this theory in my studies of the distribution of the freshwater Decapods, and have been able to collect further material in support of it. And further, in the report on the Tertiary Invertebrates of Patagonia, collected by the Princeton Expedition, which is in course of preparation, I shall again refer to this theory as a very acceptable one for the explanation of certain features in the distribution of marine animals. Therefore, I was much surprised to see that v. Ihering refers to my studies on the freshwater crabs and crayfishes as at variance with his theory, for only in this sense I can interpret his reference to my 'biologic' barrier.

My theory of a 'bioccenotic barrier' formed by the *Potamonidæ* (tropical fresh-water crabs) for the *Potamobiidæ* and *Parastacidae* (crayfishes, restricted to the extratropical parts of either hemisphere) was formulated to explain only the *Bipolarity* of the latter groups, without any reference to the special conditions in South America, but chiefly in respect to those prevailing in the old world.* I shall discuss this question again,† and shall pay particular attention to the South American conditions with reference to v. Ihering's theory: I think that the South American *Parastacidæ* are members of the old Archiplatan fauna, and are connected genetically with the New Zealandian and Australian *Parastacidæ*, and have reached these parts apparently by way of a land connection across the Antarctic regions, while the South American *Potamocarcininæ* (subfamily of *Potamonidæ*) are characteristic of the old Archamazonian fauna, and point possibly to a former connection of the latter with Africa (v. Ihering's *Archhelenis*). In this connection I must add that v. Ihering's argument, given in the article referred to, as to the coexistence of *Potamocarcininæ* and *Parastacidæ* in southern Brazil is probably a mistake: there are to my knowledge no *Potamocarcininæ* in southern Brazil, but the fresh-water crabs of small size, to which he probably alludes, are *Trichodactylinæ*, the genetic relations of which are doubtful. They have nothing at all to do with my 'bioccœnotic barrier,' and certainly do not 'annul' it.

In favor of the theory of a former disconnection of the northern and southern parts of South America I may call attention to other considerations. A communication of the Atlantic and Pacific Oceans in Tertiary times is generally accepted, and this connection is chiefly placed at Panama. Now (according to Hill), ‡ the Isthmus of Panama was land since Mesozoic times (with only an unimportant interruption at the end of the Eocene); but Hill himself admits that there must have been a connection of oceans somewhere in the Tertiary. The theory of v. Ihering gives us a clue to this. If we move the interoceanic connection from Panama southward, and construct it where there must have been the sea separating Archamazonas and Archiplata, that is to say, across

* See 'Bipolaritaet' in: Zool. Jahrb. Abt. f. Syst. v. 9. 1896, p. 593.

†'Decapoden' in Bronn's 'Klassen und Ordnungen,' vol. 5 Abteil. 2, p. 1289. This part has not yet been issued, and I am quoting from proof sheets.

‡ *Bull. Mus. Comp. Zool.*, v. 28, No. 5, 1898.