work them over into more popular form, with the inevitable errors, inaccuracies and misrepresentations which characterize such productions. Professor MacMillan has wisely chosen to supply his own popular edition.

CHARLES E. BESSEY.
THE UNIVERSITY OF NEBRASKA.

SCIENTIFIC JOURNALS AND ARTICLES.

The American Naturalist for February has for its first article a paper by Henry Fairfield Osborn on 'The Angulation of the Limbs of Proboscidia, Dinocerata and other Quadrupeds in Adaptation to Weight.' Stephen R. Williams discusses 'The Specific Gravity of some Fresh Water Animals in Relation to their Habits, Development and Composition,' the conclusion being that the movements of an animal are closely related to its density and this in turn to its food habits. Carl H. Eigenmann and George Daniel Shafer describe 'The Mosaic of Single and Twin Cones in the Retina of Fishes,' Thomas H. Montgomery has a 'Note on the Genital Organs of Zaitha,' and Maynard M. Metcalf in 'Willey on the Enteropneusta' directs attention to some of that author's far-reaching theoretical conclusions. The 'Synopses of North American Invertebrates' are again continued, Mary J. Rathbun contributing the seventh part on the Cyclometopous or Cancroid Crabs. The balance of the number is occupied with reviews of recent literature.

IN *The Osprey* for February, Paul Bartsch continues his 'Birds of the Road,' and under 'Esthetic Birds' is given Beccari's account of the Gardener Bird of New Guinea. Eugene S. Rolfe presents 'Nesting Notes on the Waders of the Devil's Lake Region,' and W. E. Clyde Todd has an excellent article on 'The Requirements of a Faunal List,' while Philo W. Smith, Jr., describes the 'Nesting of Stephen's Whip-poor-will.' The editor contributes some valuable comments on 'The Origin of the Hawaiian Fauna,' and there are some interesting letters and notes.

THE *Journal of the Boston Society of the Medical Sciences* for January 16th, has for its leading article a paper by Theobald Smith on 'Variation among Pathogenic Bacteria,' a subject to which Dr. Smith has paid particular attention for many years. As he states, on the one hand the element of variability has been overlooked, and on the other hand the tendency to concede to bacteria any degree of variability, has given rise to theories which leave but little importance to pathogenic bacteria in the ætiology of disease. The writer concludes that since new disease germs are not constantly appearing the inference is that most species cannot adapt themselves to a parasitic existence. Mark W. Richardson has a note 'On the Cultivation of the Typhoid Bacillus from Rose Spots'; E. W. Taylor describes a case of 'Gumma of the Oblongata,' remarkable for the location and size of the tumor, and James H. Wright notes 'A Simple Method for Anaërobic Cultivation in Fluid Media.'

A Revue des revues d'histoire naturelle has been established at Paris under the direction of MM. Coupin and de Courdirban. It is published bi-monthly.

DR. A. S. EAKLE, assistant in mineralogy at the University Museum, has become the American editor for Groth's *Zeitschrift für Krystallographie.*

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF BIOLOGY.

AT the meeting of February 12, 1900, presided over by Professor Bashford Dean, the following program was offered:

J. A. MacGregor, 'On the Development of the Skull in Ceratodus.'

F. B. Sumner, 'Kupfer's Vesicle in Relation to Gastrulation and Concrescence.'

G. S. Huntington, 'Some Muscle Variations of the Pectoral Girdle.'

J. H. MacGregor gave a brief preliminary report on the development of the skull in Ceratodus, the Australian lung-fish. The research was made conjointly with Professor Bashford Dean.

Only the early stages of the chondrocranium have as yet been studied; but it is noteworthy that these early stages show even closer resemblance to the amphibian skull than does the adult. The suspensorium is autostylic from the

first, and the union of quadrate to cranium by ascending and otic processes is exactly as in urodele amphibia. The hyomandibular appears later than the body of the hyoid arch, and has no connection with the jaws. The trabeculæ are widely separated, leaving a large ventral fontanelle, also an amphibian character. The palatopterygoid bar is almost entirely suppressed. The one character which is entirely fishlike is the otic capsule.

A summary of Mr. Sumner's paper is as follows:

I. The generally accepted account of the gastrulation in the Teleosts as proposed first by Götte, was shown to be incomplete, in so far as it failed to give a true account of the hypoblast.

II. A view of Kupfer's vesicle was maintained, closely similar to that proposed by the great morphologist after whom the structure has been named.

III. The present author has arrived, on purely morphological grounds, at a view of concrescence identical with that proposed by Kopsch on the basis of the latest experimental work.

Dr. George S. Huntington's paper dealt specifically with the retro-clavicular group of supernumerary muscles, for the purpose of determining their mutual relationship and common derivation. The new muscle, here described for the first time, completes a series of retro-clavicular aberrant muscles which represent different stages in migration and recession of the typical mammalian M-sterno-chondro-scapularis. The members of this group appear therefore as myo-typical reversions representing persistent portions of this muscular plane, with secondary skeletal attachments depending upon the degree of recession.

FRANCIS E. LLOYD,
Secretary.

SECTION OF GEOLOGY AND MINERALOGY.

AT the meeting of February 19, 1900, with Mr. G. F. Kunz in the chair, there were sixteen persons present.

Professor R. E. Dodge announced the death of Dr. Hans Bruno Geinitz on December 30, 1899. He also stated that Professor J. J. Stevenson had been appointed by the Council of the Academy as delegate to the coming meeting of the International Geological Congress, and that the Council had voted to become a subscriber to the fund of that Congress.

The Chairman briefly discussed the character and work of Dr. Geinitz, and, on motion, Professor Stevenson was appointed a committee to prepare a minute on this great loss to the Academy and to science.

The following specimens were exhibited by the Chairman:

Corundum from Raglan Township, Ontario, Canada.

Variously colored sapphires from a new locality, Clear Creek, Granite county, Montana.

Corundum from a serpentine dike at a new locality, Corundum Hill, Plumas county, California.

The regular paper of the evening was then read by Dr. Henry S. Washington, illustrated by diagrams and specimens:

'The Igneous Complex of Magnet Cove, Arkansas.' The structure of the complex is described and, from the evidence of the form of the area, the relations to the surrounding shales, the presence of an overlying zone of metamorphosed rock, the arrangement of, and the serial petrographical and chemical characters of the main rock types, with other minor points, the conclusion is drawn that the igneous complex is probably a laccolith, and certainly a unit; and that the main component abyssal rocks are not due to successive injections, as was suggested by J. F. Williams, but are the result of a differentiation *in situ* of the mass of magna.

The main rock types are described, some new analyses being given, and they are shown to form a regularly graded series of interesting rocks, ranging from basic jacupirangite, through biotite-ijolite, typical ijolite, shonkinitic syenite and leucite-syenite, to foyaite. This serial, and common genetic character is shown both mineralogically and chemically. It is probable that the dikes of tinguaite and nepheline-porphyry are aschistic, while those of monchiquitic rocks are diaschistic.

The arrangement of the abyssal rocks is shown to differ radically from most other cases of differentiated laccolithic masses and dikes, in that there is progressive increase in acidity

toward the periphery. One or two other instances of this are mentioned, the most closely analogous being the laccolith at Umptek in Kola (Finland).

An explanation of this is given, based on a process of fractional crystallization or freezing of the magma, and the idea applied to other cases. It is suggested that the laccoliths and similar magnetic masses, which have been studied, may be referred to three distinct types, the differences between which would be satisfactorily accounted for by the hypothesis.

In the ensuing discussion Dr. Washington pointed out that the specimens of the rocks represented by his analysis had not been selected in a radial line, but at various directions at increasing distances from the central mass of basic constitution.

Alexis A. Julien,
Secretary of Section.

TORREY BOTANICAL CLUB.

At the meeting of January 31, 1900, six new members were elected.

The scientific program consisted of a paper on the cultivation of palms, by Mr. Henry A. Siebrecht. After a general discussion of the palms as a botanical group, and of the various types represented in tropical regions, a full and interesting account was given of their cultivation in conservatories and as house plants, with valuable suggestions for their treatment and care in the household. The characters of various species suitable for cultivation indoors were given, especially of the genera *Cocos*, *Kentia*, *Phœnix*, *Areca*, *Caryota*, *Licula* and *Thrinax*, of which fine illustrations were shown from Mr. Siebrecht's nurseries. Among these were *Cocos Weddelliana*, *Phœnix Canariensis*, *P. Rupicola*, *Areca lutescens* and *Licuala grandis*. An acconnt of Mr. Siebrecht's extensive nurseries in the tropical regions of Trinidad was afterwards added by request of some of the members.

Discussion followed by Mr. Henshaw, Mr. Lighthipe and Dr. Rusby.

L. M. Underwood,
Secretary pro. tem.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 513th meeting of the Society was held at the Cosmos Club on February 17th. Professor T. J. J. See, of the Naval Observatory, on behalf of the committee on Mathematical Science, presented a brief report on the progress of Theoretical Astronomy during 1899. Attention was drawn to the completion of *M. Poincaré's Méthodes nouvelle de la mécanique*, a work of the highest theoretical interest, and promising important practical extension in certain directions. It seemed probable that the methods depending on periodic solutions will be of much greater use in connection with the theories of stability and limits of variations, than in the practical construction of tables.

The progress of the Lunar Theory in the hands of Professor E. W. Brown was noted, and attention was drawn to the necessity for a practical test of the theory in the way of the construction of new tables for the Moon. The speaker thought the Nautical Almanac Office might take up the Lunar Theory in the near future as one of its principal lines of work.

The report noted the progress of Professor Eichelberger's researches on the tables of the Watson Asteroids, and Professor Stone's researches on the theory of the perturbation of Hyperion. Attention was also called to Professor Brown's researches on the satellite of Neptune, which enabled him to deduce the oblateness of the planet from its perturbative effect on the motion of the Satellite.

Professor See referred to his own researches on the Sun's heat, recently published by the Academy of Science of St. Louis, and said he had some investigations in progress which would give more accurate theories of the densities and moments of inertia of the planets. In conclusion it was pointed out that if no discovery of an especially striking character had been made during the past year, it was apparent that the progress was steady and continuous, and touched some of the most delicate problems of the heavens.

Mr. Henry Farquhar read a paper on the 'Formation of a table of *n*th powers by means of their successive differences.' A rule was given and demonstrated for calculating any power of the natural series of numbers from 0 upwards, by simple addition, combined with multiplication by factors in no case exceeding the index

of the power. The first number in the series of first differences is always 1; the first in that of the second differences the difference between $2^n - 1$, and 1 or $2^n - 2$; while the third series is evidently headed by $3^n - 3 \cdot 2^n + 3$, the fourth by $4^n - 4 \cdot 3^n + 6 \cdot 2^n - 4$, and the q^{th} by

$$q^n - q(q-1)^n + \frac{q(q-1)}{2}(q-2)^n - \frac{q(q-1)(q-2)}{2 \cdot 3}(q-3)^n + \cdots$$

The derivation of these numbers for the nth power from similar numbers for the $n-1$th power is very simple, since

$$q^n - q(q-1)^n + \frac{q(q-1)}{2} q-2)^n - \cdots = q\Big[q^{n-1} - q(q-1)^{n-1} \cdot + \frac{q(q-1)}{2}(q-2)^{n-1} - \cdots + (q-1)^{n-1} - (q-1)(q-2)^{n-1} + \cdots\Big]$$

The table below shows the succession of leading differences for each power as far as the fifth; figures in the column to the left denoting powers, and each number in the body of the table being the sum of that immediately above it and that immediately to the left of the latter, multiplied by the factor at the head of its column. The calculation of a table of fourth powers is also indicated to the right; the numbers at the top being taken from the preceding table, and each of the rest being the sum of that immediately above it and that immediately to the right of the latter. The number 24, in the last column, is a constant additive to the column preceding. The successive fourth powers appear in the left-hand column of the calculation.

	1	2	3	4	5
1	1	.	.	.	.
2	1	2	.	.	.
3	1	6	6	.	.
4	1	14	36	24	.
5	1	30	150	240	120

.	.	1	14	36	24
1	1	15	50	60	.
2	16	65	110	84	.
3	81	175	194	108	
4	256	369	302		
5	625	671			
6	1296				

A paper by Mr. J. R. Eastman on the 'Treatment of Reflection Observations at Greenwich Observatory,' announced for the evening, was not read on account of the unavoidable absence of the author.

E. D. PRESTON,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

THE 98th regular meeting was held at the Cosmos Club, February 28, 1900.

Under informal communications Mr. G. K. Gilbert called attention to the peculiar level character of the ledges of rock crossing the bed of the Potomac, just above Harpers Ferry, and also in the bed of the Columbia river, near the mouth of the Umatilla. It was suggested that subaërial disintegration is effective in reducing, to approximately the water level, those portions of the rocky bed which are not ordinarily covered with water.

On the regular program Mr. W J McGee presented a paper on 'The Gulf of California as an Evidence of Marine Erosion.' It was shown that the powerful tides of the Gulf, aided by frequent gales, are the cause of vigorous marine erosion where the tidal currents are constricted by the islands Tiburon, Esteban, and San Lorenzo. The erosion results in submarine terraces, up to a mile in width, covered with shallow water, and backed by precipitous coastal cliffs. At the outer edges of these terraces there is a rapid descent into deep water.

A discussion on 'The Conditions of Formation of Conglomerates, and Criteria for distinguishing between Lacustrine and Fluviatile Beds,' was introduced by a paper from Professor W. M. Davis, briefly summarizing the criteria available for discriminating the two classes of deposits, and suggesting that the term *continental* proposed by Penck, should be used in those cases where it is not possible to determine whether a given deposit is lacustrine or fluviatile.

Mr. G. K. Gilbert followed with a short analysis of the conditions governing the formation of conglomerates. The dominant agencies are littoral and fluviatile. Hence the presence of conglomerates, in the absence of contrary evidence, indicates stream or shore action. The formations of Lake Bonneville and the superficial deposits of the Great Plains were determined as lacustrine and fluviatile respectively, not from the internal evidence of the deposits, but on physiographic grounds.

Mr. S. F. Emmons, referring especially to the regions covered by the Fortieth Parallel

Survey, stated that a fluviatile origin for the tertiary beds of the west was not considered, because their lacustrine nature was indicated by physiographic evidence.

Mr. Whitman Cross cited Blanford's description, published in 1879, of the Gondwána beds in India, and pointed out that the conclusion, then announced, as to the probable origin of these and other beds in India had probably been overlooked by geologists quite generally. The same criteria applied to the tertiary and mesozoic beds of the Rocky Mountain region would lead to the conclusion that many of them were of fluviatile origin. Mr. Cross, however, questioned the value of the criteria employed by Blanford, Penck and Davis, and would give most weight at present to the extent and distribution of the formations in question, and their relation to continental areas.

Mr. Bailey Willis remarked that he had been in the habit of reasoning back from conglomerates in order to reconstruct former physiographic conditions. Thus the conglomerate of the Puget Sound Basin, covering perhaps 10,000 square miles, was formed by glacial streams in Pleistocene time. The Pliocene conglomerates of California are delta deposits and are associated with uplift. The Eocene conglomerate of Washington State was laid down at the foot of steep bluffs of granite. The Pottsville conglomerate, composed almost wholly of residual quartz and widely distributed, can have been derived only from a coastal plain where it had been concentrated by marine action, and thence distributed by marine or fluviatile currents.

Mr. G. F. Becker pointed out that a lake was often only an expanded river and suggested that a more useful distinction than that between lacustrine and fluviatile deposits, would be one between materials laid down in rapidly moving and in comparatively still water. Deposits laid down by streams have their particles imbricated in one dominant direction. Beach deposits are capriciously imbricated and their pebbles are asymmetric.

F. L. Ransome,
David White,
Secretaries.

BIOLOGICAL SOCIETY OF WASHINGTON.

The 319th meeting was held on Saturday evening, February 24th. W. A. Orton spoke of 'The Sap Flow of the Maple in Spring,' describing a series of experiments undertaken with a view of ascertaining the cause of the the phenomenon. The results showed that it was due to plant physics rather than plant physiology, and had a direct relation to temperature, the sap being expelled by the expansion, caused by warmth, of the gas contained in the wood cells. M. B. Waite described 'The Peach Orchards of Michigan,' stating that they were located on the eastern shore of Lake Michigan, this body of water having the effect of mitigating the temperature of the region. Most of the farms, the speaker stated, were comparatively small, running from fifty to eighty acres in size, but owing to the methods of cultivation they yielded a good profit. Various methods of cultivation were discussed and the speaker touched briefly upon the disease of the peach known as 'little peach.' Both papers were illustrated by lantern slides.

F. A. Lucas.

DISCUSSION AND CORRESPONDENCE.

INFINITESIMALS.

To the Editor of Science: Will you kindly accord me space for a few remarks about Infinity and Continuity which I seem called upon to make by several notes to Professor Royce's Supplementary Essay in his strong work 'The World and the Individual'? I must confess that I am hardly prepared to discuss the subject as I ought to be, since I have never had an opportunity sufficiently to examine the two small books by Dedekind, nor two memoirs by Cantor, that have appeared since those contained in the second volume of the *Acta Mathematica*. I cannot even refer to Schröder's Logic.

1. There has been some question whether Dedekind's definition of an infinite collection or that which results from negativing my definition of a finite collection is the best. It seems to me that two definitions of the same conception, not subject to any conditions, as a figure in space, for example, is subject to geometrical conditions, must be substantially the