

Frog (*Rana virescens*),’ by Irving Hardesty. ‘Anastomosis of Nerve Cells in the Central Nervous System of Vertebrates,’ by N. Worth Brown, with plate; ‘A brief Summary of the Researches of Theodore Kaes on the Medullation of the Intra-cortical Fibers of Man at different Ages,’ by Helen Bradford Thompson; ‘Book Notices.’

THE *Botanical Gazette* for November contains an important paper, by Burton E. Livingston, of the University of Chicago, on the nature of the stimulus which causes the change of form in polymorphic green algæ. The form used was a species of *Stigeoclonium*, and it was made to assume the spherical or filamentous form and to organize zoospores or not at will. The evidence seems perfectly clear that the responses, both in form and reproductive activity, are due to changes in the osmotic pressure of the medium and are in no way functions of its chemical composition. A high osmotic pressure decreases vegetative activity, inhibits the production of zoospores, causes cylindrical cells to become spherical, and frees the alga from certain limitations as to the orientation of planes of cell division, while a low pressure has the diametrically opposite effect in each case. Professor Conway MacMillan publishes some careful observations upon the structure of *Lessonia*, one of the huge Laminaria forms. The material studied was cast up upon the beach of Vancouver Island. Mr. C. D. Beadle, of the Biltmore Herbarium, describes ten new species of *Cratægus*. Mr. John F. Cowell, Director of the Buffalo Botanic Garden, gives an appreciative biographical sketch, with portrait, of the late David F. Day. Mr. Carleton E. Preston, of Harvard University, records some field observations as to the root system and vegetative propagation of Cactaceæ.

Popular Astronomy for December has for a frontispiece the New Allegheny Observatory, whose corner stone was recently laid. The address delivered upon this occasion by J. A. Brashear is given in full, as well as notes descriptive of the corner stone exercises and the building itself. Another topic of interest to general readers is that of the *Leonid Meteors* watched for last year and this. Pro-

fessor W. W. Payne discusses their orbit, and the results of the observations made at various points this year are noted and charted. Kurt Laves’ practical help on the ‘Adjustment of the Equatorial Telescope’ is continued in this number, and Charles P. Howard’s paper on the ‘Total Eclipse, of May 28, 1900,’ is begun. E. S. Holden writes, ‘Among the Stars,’ and S. W. Burnham contributes two short articles on double stars. Many brief reports of the Eros observation work are included in the general notes, which, with the usual Spectroscopic, Planet, Comet, Asteroid notes, completes the last number of the volume for 1900.

SOCIETIES AND ACADEMIES.

GEOLOGICAL SOCIETY OF WASHINGTON.

THE 104th regular meeting was held at the Cosmos Club, November 14, 1900.

The following papers were presented :

‘Notes on Lake Chelan and Vicinity,’ by Mr. Bailey Willis.

The Cascade Mountains of Washington State constitute a plateau, so thoroughly dissected, however, that none of the original surface remains. The greater number of the resulting sharp peaks and ridges have summits close to an imaginary sloping plane ranging in altitude from 3,000 to 8,000 feet. The initial uplift was succeeded by development of moderate relief, followed by the last and principal elevation. It is not yet known whether this final uplift is late Pliocene or early Pleistocene. Lake Chelan lies in an area of metamorphic and igneous rocks, the oldest of which are schists of sedimentary origin. They are cut by younger granitic rocks. These in turn are traversed by dikes of andesite, diorite porphyry, and acid quartzose porphyries.

‘Remarks on Troost’s Geological Map of the Environs of Philadelphia, 1826,’ by Mr. G. P. Merrill.

A copy of this rare map, which the Marcous, in their catalogue of geological maps of North America, state is unknown, was exhibited to the Society.

‘Ore Deposits at Monte Cristo, Washington,’ by Mr. J. E. Spurr. Among the rocks of the Monte Cristo district are arkoses and

quartzites, and a variety of volcanic rocks, comprising andesites, rhyolites, dacites and basalts. There were two periods of andesitic eruption. The arkoses and the older andesites which are among the most ancient rocks, are cut by large dikes of tonalite, which have altered the intruded rocks near the contact to quartz, biotite, garnet and staurolite schists. Strong, steeply dipping, jointing or sheeting is one of the latest geologic structures, and accepting the principal uplift of the range as late Pliocene, the jointing is probably not older. Along these joints most of the ore deposits have formed. The ores consist chiefly of arsenopyrite, chalcopyrite, pyrrhotite, pyrite, blende, galena and some less important sulphides. The deposits occur mainly in the tonalite and to a less extent in the older andesites, occasionally in the other rocks.

'The Mother Lode, folio, California,' by Mr. F. L. Ransome.

This special mining folio No. 63 of the Geologic Atlas of the United States was shown and its scope briefly outlined. It deals with an area six and a half miles wide and seventy miles long, embracing the greater portion of the so-called 'Mother Lode' system of gold-quartz veins.

'Paleobotanical Aspects of Some Upper Paleozoic Formations of Nova Scotia,' by Mr. David White.

A brief *résumé* of the correlations by stratigraphy on the one hand with the correlations by paleontology on the other hand. The Horton and the Riversdale plant beds, which are referred by the Nova Scotia geologists to the Hamilton, are, on the evidence of the fossil plants, referable to two stages; the Horton being Pocono and in the basal portion of the lawn Carboniferous, while the Riversdale plants indicate a stage for these at or near that of the Pottsville.

F. L. RANSOME,
DAVID WHITE,
Secretaries.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF BIOLOGY.

THE regular monthly meeting November was held on the evening of November 12th, Professor C. L. Bristol, presiding.

The following program was offered :

F. C. Waite, 'The Bermuda Toad' (to be published in full in SCIENCE).

H. F. Osborn, 'The Phylogeny of the Rhinoceroses of Europe.'

H. L. Clark, 'Further Notes on Bermuda Echinoderms.'

Professor Osborn reported a continuation of his investigations upon the 'Phylogeny of the Rhinoceroses of Europe.' These animals appear to fall under the law of early divergence, and to constitute at least six separate series or phyla, which, so far as known at present, are not genetically related to each other, but undergo a more or less parallel development, as follows: Diceratheriinae, Aceratheriinae, Brachypodinae, Ceratorhinae, Atelodinae, Rhinocerotinae. The chief criteria in distinguishing rhinoceroses are the proportions of the skull, whether dolichocephalic or brachycephalic, the proportions of the limbs in reference to cursorial or aquatic habits, and the position of the horns; subsidiary to these features are the types of tooth structure. The origin of the Rhinoceroses is still obscure, although it appears to be possible to derive the Diceratheriinae from certain Eocene Hydracodontidae.

This study will be published in full in the *Bulletin* of the American Museum of Natural History, and it constitutes a part of the continuation of the author's memoir on the extinct Rhinoceroses.

Mr. H. L. Clark's paper was read by Professor C. L. Bristol. In this paper Mr. Clark gave an account of the Echinoderms collected by the party of zoologists from the New York University in the summer of 1899, together with a summary of his own observations during April of that year. It is to be concluded from an abundance of observations that the distinctions hitherto thought to exist between *Stichopus diabolii* and *acanthomela* are not to be regarded as valid, and the forms described under these names must be referred to *S. Möbii*. Twenty-nine species are listed.

Mr. Waite called attention to the fact that the madreporic body in *Asterias tenuispina* branches, forming 1-4 bodies in each animal, thereby making orientation difficult.

F. E. LLOYD, *Secretary.*

TORREY BOTANICAL CLUB.

At the meeting of the Club on October 31st, Dr. P. A. Rydberg read a paper on 'The Melanthaceæ of the Rocky Mountains.' Numerous herbarium specimens were exhibited, including the types of seven new species described by Dr. Rydberg in the *Torrey Bulletin* for October. To these descriptions he now added further particulars regarding habit, distribution and critical characters, presenting also a series of comparative drawings of their petals and sepals. One of these new species of especial interest is *Veratrum speciosum*, to which most of the specimens previously ascribed in herbaria to *V. Californicum* prove to belong. The presence of conspicuous petioles at the lower leaves of typical *V. Californicum* was demonstrated from the type-specimen and also by explicit accompanying statements by Dr. Asa Gray, whose manuscript description was produced.

EDWARD S. BURGESS,
Secretary.

ZOOLOGICAL JOURNAL CLUB OF THE UNIVERSITY OF MICHIGAN.

The first meeting of the club was held November 1st. Dr. S. J. Holmes reported the results of work done at Woods Holl during the past summer on the habits and natural history of *Amphithoe longimana* Smith. The observations made were upon the movements of the animal, food, nest-building and instincts associated with living in nests, moulting, color changes, the seat of smell and the instincts of the young.

Mr. L. J. Cole gave an account of work done at Woods Holl during the past summer on the habits of *Pycnogonids*. Most of the notes were based on observations of *Anoplodactylus*, though *Tanystylum* and *Pallene* were studied also.

Crawling and Swimming Movements.—The action of the legs in crawling and in swimming was analyzed and was found to be exactly the same in the two cases. When the stroke of the legs is strong enough to lift the animal from the bottom, swimming results; otherwise the same movement produces crawling along the bottom. The stroke of all the legs is the same except that it is stronger in the anterior legs, and this is what carries the animal forward in

crawling, rather than backward. The action of the posterior legs is an actual hindrance in crawling.

Reactions to Light.—1. Both *Anoplodactylus* and *Pallene* show strong positive phototaxis. In going towards the source of light *Anoplodactylus* may either crawl or swim, being oriented differently in the two cases:

2. In crawling towards the light the animal progresses forward. If not oriented in this direction at first it becomes so oriented by making a short circle in every case towards the light.

3. When an animal walks in a circle those legs on the outside must make a more effective stroke than those on the inside, which means in this case that *those legs away from the light beat stronger than those towards the light*.

4. In swimming towards the light the animal progresses approximately *backward* with the anterior end somewhat raised, the amount depending upon the activity of the individual and the slant of the rays of light.

5. This orientation is brought about by the actions previously mentioned: (a) The stronger action of the legs on the side away from the light raises that side, and the animal consequently travels toward the light; (b) The stronger action of the anterior legs, as compared with that of the posterior, tends to bring the anterior end of the animal into the upper position, giving the orientation described.

Transfer of the Eggs from the female to the ovigerous legs of the male.—When first observed the male was clinging to the dorsal surface of the female and headed in the same direction. The basal joints of the legs of the female were approximated below with a mass of eggs between. The male crawled around over the anterior end of the female, coming into such a position that their ventral surfaces were together and their heads in opposite directions. The ovigerous legs of the male hooked into the mass of eggs, and as the animals separated carried them away. Fertilization presumably took place at the same time.

At the second meeting, November 8th, Dr. S. J. Holmes presented an account of work done during the past summer at Woods Holl on Phototaxis in Amphipods.

Most of the experiments were performed on

two species of *Orchestidæ* found at Woods Holl, Mass., *Talorchestia longicornis* and *Orchestia agilis*. *Talorchestia* was found to be positively phototactic at all times both in strong and in weak light. *Orchestia agilis* is somewhat less strongly positive since, for a short time after it is taken from the dark, it becomes negatively phototactic, but exposure to the light soon makes all the individuals strongly positive and they remain so even in direct sunlight. Both these species when exposed to direct sunlight remain positively phototactic until overcome by the heat of the sun. Yet the animals when they come to rest are found in shaded spots and, during the daytime, remain unexposed to the light; they are photophobic, but positively phototactic. Observations were made on twenty-two species of aquatic amphipods, all of which were found to be negatively phototactic. It was found that when the terrestrial *Orchestia agilis* were thrown into sea water their phototaxis immediately changed from positive to negative; when taken out of the water the reverse change occurs, and this change was shown to be independent of temperature.

Orchestia agilis, when brought from strong light, in which it is strongly positive, to weak light, immediately becomes strongly negative, a result which, it is believed, has been observed in no other form. When left in weak light the negative phototaxis disappears and all the specimens become positive again. This result was shown to be independent of temperature. Specimens rendered negative by being brought into a dimly lighted room after exposure to strong light become positive more quickly if the temperature is raised. Exposure to darkness or to very strong light renders *Orchestia agilis* temporarily negative in light of medium intensity.

In *Talorchestia*, *Orchestia*, and several species of insects that are positively phototactic it was found that, when one eye is blackened over, the animal travels in circles with the unblackened eye looking towards the center. In several negatively phototactic forms blackening one eye was found to produce circus movements in the other direction, the unblackened eye looking away from the center. *Orchestia agilis* may be caused to execute circus movements in the one

or the other direction according to whether it is placed in air or water. H. S. JENNINGS,

Secretary.

DISCUSSION AND CORRESPONDENCE.

THE ELECTRICAL THEORY OF GRAVITATION.

PROFESSOR FESSENDEN in a recent number of *SCIENCE* discusses the nature and velocity of gravitation. There is, no doubt, something of value in Professor Fessenden's suggestions and much that is new. However, the explanation of gravitation which Professor Fessenden offers is by no means so adequate as would appear from Professor Fessenden's discussion.

In the first place, *Quantitative Mathematics*, as Professor Fessenden styles his papers on Dimensions, has little or nothing to do with the thing. The present writer makes this statement not entirely as an expression of his own opinion, but quite as much as an expression of opinion of every physicist with whom he has talked on the matter. Professor Fessenden claims to have derived *numerical functional relations*, with the aid of his 'Qualitative Mathematics,' and this is believed on definite rational grounds by most physicists to be impossible.

One of the best examples of the application of 'Qualitative Mathematics' is its application by Lord Rayleigh (*Philosophical Magazine*, October, 1899), in his 'Investigation on Capillarity.' In this instance the weight of a drop of water falling from the end of a glass tube is shown to be a certain function of radius of tube, density of water, acceleration of gravity and surface tension of water *multiplied by an unknown function of these quantities having zero dimensions in length, mass and time*. This unknown and unknowable function—to be determined by experiment only—Fessenden seems to lose sight of in his 'Qualitative Mathematics.' The reader who wishes to get the gist of Professor Fessenden's suggestions as to the nature of Gravity may therefore, as it seems to us, ignore what he says of, and is, led to say by 'Qualitative Mathematics.'

The following is a brief and fairly simple outline of the electrical hypotheses which are now held by physicists in the attempt to explain the ultimate constitution of matter and the nature of inertia and of gravitation.