articulare, which sometimes remains distinct, but more often fuses with the articulare. Other articles are 'Natural and Artificial Parthenogenesis,' by Alexander Petrunkevitch; 'The Angle of Deviation from the Normal Vertical Position at which Stems show the Strongest Geotropic Response,' by Julia A. Haynes (a difficult title for the cataloguer), and 'Note on the Variation in the Bay Flowers of Rudbeckia,' by Raymond Pearl.

*The Popular Science Monthly* for April contains a most important article, 'The Menace to Niagara,' by John M. Clarke, showing the entire probability that the American Falls will be destroyed if present plans are carried out. Other articles are 'Sunspots and Weather,' by Ernest W. Brown; 'Medical Research, its Place in the University Medical School,' by Theobald Smith; 'The Problem of Immigration,' by Allan McLaughlin; 'Age and Eminence,' by Edwin G. Smith; 'Authority in English Pronunciation,' by Edwin W. Bowen, which shows the part dictionaries play in fixing the pronunciation of words, and, finally, 'The Bermuda Islands and the Bermuda Biological Station for Research,' by Edward L. Mark. In correspondence Olivia R. Fernow discusses the question 'Does Higher Education Unfit Women for Motherhood' in reply to the somewhat hysterical article by Dr. Smith in March. The number completes Volume LXVI. and has the index.

## SOCIETIES AND ACADEMIES.

### THE NEW YORK ACADEMY OF SCIENCES. SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY.

THE regular meeting of the section was held on Monday evening, January 8, at Fayerweather Hall, Columbia University.

The following papers were presented:

*Experiments Relating to the Conductivity of Powders at High Temperatures:* HERSCHEL C. PARKER.

When a conducting powder like graphite is mixed with a non-conducting refractory powder, the resistance increases quite rapidly at first; as the proportion of graphite is decreased, then more slowly, and after a time reaches a critical point where there is no conduction or the graphite is destroyed by arcing.

When the percentage of the conducting powder is low a mechanical separation or 'striation' takes place on packing in the refractory tubes. Besides this an electrolytic separation usually takes place after a time and the conductivity of the mixture is destroyed by arcing.

A very great variety of substances and mixtures were experimented with in the search for a permanent compound of high resistance.

*The Magnetic Susceptibility of Water:* A. P. WILLS.

Experiments were made with the large electro magnet of Columbia University to determine the magnetic susceptibility of water. With the aid of this magnet, which is one of the largest in existence, Dr. Wills found the coefficient of susceptibility of water to be $-0.72 \times 10^{-6}$, and also to be independent of the field strength over a range from 4,000 to 16,000 C.G.S. units.

C. C. TROWBRIDGE,
*Secretary.*

### SECTION OF BIOLOGY.

AT the March meeting papers were presented by Mr. L. I. Dublin, of the College of the City of New York; Mr. Frederic A. Lucas, director of the Brooklyn Museum; and Professor F. S. Lee, of Columbia University.

Mr. Dublin described the history of the germ-cells in *Pedicellina americana,* giving special attention to the chromatic changes. The somatic number of chromosomes is twenty-two. These bodies behave, throughout, very much as has been described by many workers on other forms; but in addition there has been observed a peculiar process in connection with the reduction of the chromosomes. These are V-shaped in the somatic cells and in the several generations of oogonia and spermatogonia, with the exception of what appears to be the last. In this the number is still twenty-two, but they are bar-shaped. These divide and, either before or at the telophase, apparently unite end to end in pairs to form eleven new V's, each bivalent as compared with the earlier

structures. A longitudinal splitting of these loops, coincident with the extensive growth of the individuals, produces in the first maturation division eleven ring- or bar-shaped chromosomes each of which is structurally a tetrad. The first division is thus reducing; the second, equational. The change in chromosome form in the last oogonial and spermatogonial generations is then clearly a striking adaptation to the subsequent synapsis or reduction, making the latter easily possible.

Mr. Lucas gave an account of whales and whaling on the coast of Newfoundland, illustrating his remarks with stereopticon views of the whales and stages of their capture. Three species of whales were described, the finback, the humpback and the sulphur-bottom, the first two being found on the south and east coast, the last one on the south coast only. The speaker then described the past and present methods of capture and utilization, saying that whales are now worked up so rapidly that within forty-eight hours after one is brought to the whaling station, it is reduced to oil, fertilizer and bone. The lecture closed with an interesting account of the method employed in making the mold of the large model of a whale shown by the National Museum in the exhibit at St. Louis. This was possibly the largest mold ever made, and the cast was the first accurate representation of a fully grown whale.

Professor Lee discussed 'Temperature and Muscle Fatigue.' He and others have previously pointed out that the contraction process of the muscles of cold-blooded animals in the course of fatigue becomes greatly slowed, while those of warm-blooded animals show no such phenomenon. Lohmann has recently claimed that a cold-blooded muscle on being heated to mammalian temperature shows a course of fatigue similar to that of mammalian muscle; and, on the other hand, that a warm-blooded muscle on being cooled fatigues like the muscles of cold-blooded animals at a similar temperature. From these supposed effects he infers that in the matter of fatigue there is no real physiological difference between the two groups of muscle. Professor Lee has not been able to confirm Lohmann's conclusions. Every variety of muscle which has been tested, whether of cold-blooded or warm-blooded animals, shows its characteristic method of fatigue, whatever the temperature may be. The original conclusion regarding the difference between the two groups of muscles seems, therefore, to be justified.

M. A. Bigelow,
*Secretary.*

## The Society for Experimental Biology and Medicine.

The tenth regular (second annual) meeting of the Society for Experimental Biology and Medicine was held in the Rockefeller Institute for Medical Research, on Wednesday, February 15. The president, Dr. S. J. Meltzer, was in the chair.

*Members Present.*—Atkinson, Auer, Burton-Opitz, Dunham, Ewing, Flexner, Gies, Jackson, Lee, Levene, Levin, Mandel, Meltzer, Noguchi, Norris, Oertel, Opie, Park, Richards, Sweet, Wadsworth, Wallace, Wolf, Yatsu.

*Members Elected.*—George W. Crile, Haven Emerson, Cyrus W. Field, Hideyo Noguchi, H. C. Sherman, J. Edwin Sweet, Victor C. Vaughan.

*Officers Elected.—President:* Edmund B. Wilson; *Vice-President:* Edward K. Dunham; *Librarian:* Graham Lusk; *Treasurer:* Gary N. Calkins; *Secretary:* William J. Gies.

### *Abstracts of Reports of Original Investigations.**

*Degrees of Susceptibility to Diphtheria Toxin Among Guinea-pigs. Transmission from Parents to Offspring:* Theobald Smith. (Presented by William H. Park.)

Dr. Smith called attention to the usefulness of the antitoxin unit, furnished by the Institute for Experimental Therapy under the direction of Professor Ehrlich, in the routine testing of the strength of diphtheria antitoxin. The one uncertain element is the relative re-

* The abstracts presented in this account of the proceedings have been greatly condensed from abstracts given to the secretary by the authors themselves. The latter abstracts of the reports may be found in current issues of *American Medicine* and *Medical News*.

sistance of the guinea pigs to diphtheria toxin. Irregularities in the routine tests during the past year led the author to look up the genealogy of the pigs used, and he found that the different degrees of resistance belonged to certain families or litters, and were constant for those families. Thus one mother gave birth to young which did not react to what was the usual fatal dose. Four successive litters possessed the same resistance. It appeared probable that this family could stand 40 per cent. more toxin, when mixed with the antitoxic unit, than those of average susceptibility.

It would seem from these and similar observations that different degrees of susceptibility to toxin are to be found among guinea pigs and that the special degree possessed by any one is not to be attributed to individual variation, but to a family trait or character. Experiments are now under way to determine the part played by the male in the transmission of toxin-resistance.

*The Protective Action of Venom upon Blood Corpuscles,* with demonstrations: HIDEYO NOGUCHI. (Presented by Simon Flexner.)

That concentrated solutions of venom fail to destroy and tend to preserve blood corpuscles was noted by Mitchell and Stewart. The conclusion which has been reached by the author is that venom unites with the globulins, and especially with the hemoglobin, of the red corpuscles, yielding a water-insoluble compound to which the protection is due. Various substances, but only salts, acids and alkalies, restore the hemolyzability of the corpuscles by dissolving the venom-hemoglobin compound. The permeability of the corpuscles is not markedly altered.

*The Results of Attempts to Cultivate Trypanosomes from Frogs:* JOSEPH LEWIS and HERBERT U. WILLIAMS. (Presented by Augustus B. Wadsworth.)

Examinations of the blood of various lower animals were made at Buffalo, N. Y., in search of parasitic protozoa. The results were negative in dogs, cats, rabbits, guinea-pigs, English sparrows, toads and mud-puppies (*Necturus maculatus*). In frogs from the Niagara River hematozoa were found quite frequently, viz., *Trypanosoma, Drepanidium* and in one case *Filaria*. *Trypanosoma* was seen only in midsummer.

Attempts were made to cultivate *Trypanosoma* and *Drepanidium,* using a modification of the blood-agar medium, proposed by Novy and MacNeal. Trypanosomes from the frog may be cultivated on blood-agar, but, in the experience of the writers, with considerable difficulty.

From a frog infected with *Tr. rotatorium* a flagellate organism was cultivated, showing important points of difference from *Tr. rotatorium*. It is possible that, owing to the technical difficulties of the experiment, some other organism may have found its way into the tubes. This is improbable.

Undoubted trypanosomes developed in blood-agar prepared from a frog whose blood, during life, showed no trypanosomes, so that they must have been present in very small numbers or in some unrecognized form. They resembled *Tr. rotatorium,* but were usually much smaller. As this blood-culture-medium was inoculated with blood from another source containing *Drepanidium,* it nearly led to the conclusion that *Trypanosoma* might develop from *Drepanidium*. We have here an illustration of the ease with which mistakes may occur in the cultivation of hematozoa which are suspected of passing through cycles. Such a possibility had been pointed out in advance by Novy and MacNeal before this society (October, 1904).

There was no evidence from the experiments to show that development of *Drepanidium* can occur in blood-agar.

*Experimental Measles:* LUDWIG HEKTOEN. (Presented by Eugene L. Opie.)

The results of two experiments on adult men permit the conclusion that the virus of measles is present in the blood of patients with typical measles some time at least during the first thirty hours of the eruption; furthermore that the virus retains its virulence for at least twenty-four hours when such blood is inoculated into ascites-broth and kept at 37° C. This demonstration shows that it is not difficult to obtain the virus of measles un-

mixed with other microbes and in such form that it may be studied by various methods.

*The Formation of the Centrosome in Enucleated Egg-fragments:* Naohidé Yatsu.

To test whether the centrosome is a permanent cell-organ or not, Wilson (1901) treated, with a salt solution, enucleated egg-fragments (sea-urchin) obtained by shaking. He observed that asters containing centrioles and capable of division were produced in this way in the enucleated fragments. At Wilson's suggestion the author tried the experiment in a somewhat different manner. Eggs of *Cerebratulus* were used. Individual eggs were cut into *nucleated* (*i. e.,* containing the first maturation mitotic figure) and *enucleated* fragments. The latter were kept for an hour in a solution of calcium chlorid. Then they were transferred to sterilized sea-water. Asters were produced in almost all enucleated fragments thus treated. All the asters had centrioles which were identical with those found in the whole eggs subjected to the same treatment. The nucleated half was stained and was shown to have had two original centrosomes intact. From the results of these experiments no other conclusion can be drawn than that the centrosome, with centriole, of the enucleated fragment was in each case formed *de novo*—a complete confirmation of Wilson's original deduction.

In these experiments strict precautions were taken to prevent accidental fertilization.

*Structure of Vaccine Bodies in Isolated Cells,* with demonstrations: James Ewing.

In Klatsch preparations of corneal vaccine ulcers stained by Nocht's method, the vaccine body is seen to be a portion of the cytoreticulum, its reticular structure being continuous on the one hand with the cytoreticulum and on the other usually with the nuclear reticulum. The clear zone surrounding the vaccine body in sections of tissue is an artifact. The reticulum of the vaccine body takes the chromatin stain, indicating that it contains chromatin, and many of the bodies are so intimately connected with the nucleus, the meshes of one passing insensibly into the other, as to force the conclusion that these particular bodies have arisen by recent extrusion of nuclear chromatin into the cytoreticulum. Other bodies are disconnected from the nucleus and these may have arisen partly from the chromatin of the cytoplasm, a possibility which is furnished by Hertwig's theory of the constitution of cell protoplasm. Many of the vaccine bodies closely resemble the chromidial substance described by Hertwig in some lower animal cells. In the meshes of the reticulum the author has been unable to demonstrate any organized structure, but the meshes sometimes present nodal points of an underlying reticulum. In the fresh condition the meshes contain homogeneous refractive globules which disappear on drying.

Two series of changes may be followed in the vaccine bodies in Klatsch preparations. Many of them develop basic staining areas with loss of the central reticulum, and this process may continue until the entire body is transformed into a homogeneous globule resembling mucus or colloid. In others the reticulum breaks up into granules with or without the development of a central basic mass.

The author has been unable at any stage or in any derivative of the vaccine body to detect the slightest definite trace of a protozoon. Besides vaccine bodies there are other structures resembling protozoa to be seen in Klatsch preparations. They appear to be peculiar cell granules and are present in normal animals.

*On the Tetanic Element in Bile:* S. J. Meltzer and William Salant.

The authors have shown that the injection of bile can produce tetanus as well as coma. The latter is the more constant symptom. By the use of subminimum doses of strychnin a tetanic element could be shown to occur in bile that infallibly produced coma. A frog of medium size will not respond, even with the slightest hyperesthesia, to an injection of one hundredth of a milligram of strychnin. When such a small dose, however, is injected into a frog which had received a certain quantity of bile, the animal reacts, sooner or later, with a distinct tetanus. The effective dose of bile varies with the animal from which it is ob-

tained. The bile of rabbits produced, in many instances, distinctly convulsive effects even without the addition of strychnin.

The toxic effect on frogs of bile from normal rabbits varied considerably. The effect of the bile from some of the rabbits was predominantly coma, and from others tetanus. Heating the bile seemed to reduce the stupefying, paralyzing effect and to favor the appearance of the tetanic element. In the bile of nephrectomized rabbits the tetanic element was distinctly more pronounced than in the bile of normal animals.

*A Preliminary Communication on the Pharmacology of Thorium:* E. D. BROWN and TORALD SOLLMANN. (Presented by William J. Gies.)

Thorium nitrate precipitates proteids and is intensely astringent. Intravenous injection is promptly fatal by embolism. Applied subcutaneously, necrosis results. Introduced per os large doses have no appreciable effect. Solutions in sodium citrate are non-precipitant and non-astringent. Subcutaneous injection of large doses in citrate solution was without acute effect, although the animals appeared to be depressed and became emaciated, their tissues, after several weeks, showing widespread calcification. Absorbed thorium is excreted by the kidneys. The metal is neither absorbed nor excreted through the intestine.

*A Preliminary Study of the Toxicological Action of Thorium:* ARTHUR F. CHACE and WILLIAM J. GIES.

In addition to various results in harmony with those in the preceding report the authors presented the following data: In medium sized frogs at least 40 milligrams of thorium chlorid were required per os to produce the first sign of toxic symptoms, although 40 milligrams introduced subcutaneously or per rectum quickly manifested marked toxicity. Introduction per os caused irritation of the throat, increased gastric secretion, ejection of gastric contents and increased peristalsis. In fatal poisoning, by whatever channel of introduction, death was preceded by anhydrosis, twitching and progressive weakening of the muscles, with paralysis of the fore legs preceding that of the hind legs.

In warm-blooded animals large doses per os caused vomiting. In fatal cases, after introduction by other channels, death was preceded by restlessness, twitching and progressive paralysis of the muscles, labored breathing, stupor. Paralysis of the fore limbs resulted before loss of power in the hind ones.

The most constant and pronounced general effect in all the experiments was a progressive weakening of the voluntary muscles.

WILLIAM J. GIES,
*Secretary.*

## THE GEOLOGICAL SOCIETY OF WASHINGTON.

THE 164th meeting was held on February 22, 1905. The regular program included a paper by T. W. Stanton, the discussion of which was participated in by Messrs. W. H. Dall, E. O. Ulrich, David White and H. S. Williams.

*The Time Element in Stratigraphy and Correlation:* Mr. T. W. STANTON.

Recently published discussions concerning recurrent and shifting faunas and transgressing formations have called renewed attention to the character of the facts on which geological correlation is based and have emphasized the doubts as to the possibility of determining that widely separated deposits were or were not contemporaneous. The argument briefly stated is as follows:

If a fauna or a flora appears suddenly in a certain bed of a local section the only reasonable inference is that it must have developed in some other area where its presence is recorded in older deposits. Similarly, if a fauna suddenly disappears from a section it is more probable that a change in local condition has caused it to shift to some favorable locality where it continued to live until its elements were modified, than that it actually ceased to exist. That such shiftings of faunas have taken place is proved by the observed recurrence of closely related faunas in several stages of some local section, while the intermediate stages show different faunas. Admitting that there has been much local differentiation and shifting of faunas in the past, similarity of fossil contents alone can

not be taken as proof of the exact contemporaneity of two beds, and dissimilarity of fossils within certain limits is not proof of difference in age.

When a littoral deposit is formed along the margin of a transgressing sea its base at one locality will not be synchronous with its base at another locality 100 miles farther inland. The difference in date will be measured by the time required for the sea to travel 100 miles across a subsiding area. In such cases physical continuity of a formation is not proof of exact contemporaneity.

The facts are not questioned and the importance of considering them in correlation and time determinations is obvious, but it is equally important to interpret them correctly and not to exaggerate their quantitative value. If undue importance is given to the theoretical errors in time determination and correlation caused by shifting faunas and transgressing formations, there is danger of overlooking the determinations that can actually be made or of exciting unnecessary doubts concerning them. These errors as a rule are geologically trivial and scarcely measurable in terms of the large units that must be used. The degree of accuracy that is required in human history is not to be expected in geologic history in which the time unit is so large and the scale so coarse that an interval of a few centuries is often not appreciable. The accuracy of geologic correlation, so far as the idea of contemporaneity is concerned, is commensurate only with the nature of the rough scale that must be used, and varies with the completeness and the character of the evidence in each special case. In general, the farther a correlation is carried the broader must be the terms in which it is expressed, but horizons vary greatly in this respect. At irregular intervals throughout the geologic column there are limited zones characterized by species or groups of species that have almost world-wide distribution. These zones, as Professor J. P. Smith has well stated, record times of readjustment of faunal provinces when for some reason interregional migrations were made easy. They may, therefore, be treated as geologically contemporaneous wherever they are found and they serve as the solid frame-work of the general chronologic structure.

Barriers, migrating faunas and shifting shores, make the local problems of correlation more difficult in special cases. With insufficient data or insufficient experience, or both, the geologist will make many mistakes, but when all the obtainable facts are fully studied from the broadest geological standpoint, when every element of the fauna and flora is given due weight, and when this is tested and supplemented by all other available classes of evidence, he can not only make correlations, but he can determine contemporaneity within the limits of accuracy that the subject demands.

Dr. Wm. H. Dall spoke on the evidences afforded by recent faunas, as bearing on the notion of contemporaneity in fossil horizons, drawing attention to the differences in number of species contained in a fauna relatively to its latitude, varying from 180 at Greenland, to 818 in the equatorial regions, a subject fully discussed in the U. S. Geological Survey Bulletin No. 84; to the total, or nearly total, differences between the faunas of rocky, sandy and muddy shores, due not only to the different lithologic situs, but to the differences of food-supply each afforded; to the fact that to define a fauna in the paleontologic or biologic sense, our definition must be wide enough to include all these purely local variations, and represent the whole population of a coast with all its variation of conditions; to the rapid spread of prepotent species given acceptable conditions, as in the case of *Mya arenaria,* introduced on the Pacific coast, and *Litorina litorea* on the Atlantic coast of the United States, both of which are known to have extended in profuse numbers over hundreds of miles of coast where they were previously unknown, in the course of a few years.

Dr. Dall also stated that the confusion of ideas with consequent controversies which have frequently occurred in connection with these questions, are largely due to the attempts on the part of geologists to combine in one expression two irrelevant factors, the 'formation,' considered as a lithologic unit, and the fauna as a time scale. A reference to the

existing coasts is all that is necessary to prove how absurd is the idea that the 'formation' of a given area has any necessary connection with the horizon or time-place in the geological column indicated by a given fauna. The two categories are, in a broad sense, incompatible, one indicating merely local physical and dynamic conditions, and the other the stage of evolution of the organic assembly inhabiting an area probably with entirely different boundaries.

Mr. E. O. Ulrich expressed his belief that the idea that faunas required a long time to migrate from place to place is an unjustifiable assumption. The migration of the Paleozoic faunas, which included mostly shallow water organisms, was limited to zones adjacent to the shore line. The Paleozoic continent had much less relief than the present surface and the adjacent water basins were shallow, thus favoring rapid migration. With slight relief a small amount of tilting would cause rapid submergence of large areas with immediate migration of marine life. Therefore, it would result that like fossil faunas indicate at least essential contemporaneity. The case cited as illustrating such geologic conditions with the rapid spread of a fauna was that afforded by the western and southern formations of the Richmond group in the uppermost Ordovician.

Mr. Ulrich stated that his working hypothesis is that one slowly modifying fauna existed continuously on the outer border of the continent while another occupied, on the whole, much shallower and frequently changing basins upon the surface of the continent. On account of the comparatively unstable conditions prevailing there the epicontinental fauna was subjected to many vicissitudes not shared by the outer fauna. Hence considerable and often very great modifications of its character, both local and widespread, took place much more frequently than in the outer fauna. When conditions were favorable, faunas of the inner basins were, in some cases, replenished, or in others, perhaps only slightly modified by accessions from the outer faunas.

Special emphasis was put by David White, the next speaker, on the relative insignificance of the time, as measured by sedimentation, required by those faunal migrations which are not marked by changes in the composition of the fauna and recognizable mutations of the species. The interval between the two great Pleistocene ice invasions was ample for the migration of the flora and even the formation of peats in the thin deposits of interglacial clays. Between the retreat of the last ice sheet and the restoration of the faunal and floral equilibrium, as we now find it, the interval, as measured in sediments, is geologically not macroscopic. The practical contemporaneity, in the geological sense, of an identical fauna in the various parts of its distributional province is shown by the general agreement and harmony in these parts between the marine invertebrates and the other contemporaneously characteristic classes of organisms, including marine vertebrates, land plants and land vertebrates, whose directions and routes of distribution varied widely. A plea was added for a closer study and a more scrutinous characterization of species, taking into account not only the contemporaneous variation of the organism, but also especially the variations or mutations occurring within the duration of the specific type, some of these mutations being of the most restricted vertical range, and consequently of greatest stratigraphic value.

GEORGE OTIS SMITH,
*Secretary.*

## *DISCUSSION AND CORRESPONDENCE.*

### THE WESTERN SIERRA MADRE MOUNTAINS.

TO THE EDITOR OF SCIENCE: The geographical and geological expedition organized by Col. W. C. Greene for the study of the western Sierra Madre Mountains of Mexico has accomplished half of the journey proposed. The party, consisting of Professor Robert T. Hill, Messrs. John Seward and F. H. Fayant and the writer, which left New York February 4, was delayed on its journey to El Paso by blizzards in Canada and the central states and exceptional cold weather in Texas. News of heavy snowfall in the mountains caused farther delay in El Paso, which was utilized by the party for a run across the arid region along the Mexican boundary as far as Naco, Arizona, and thence to Cananea, Soñora. The