the calculus have plucked Williamson and Todhunter and each other, I recommend a raid on Perry by way of refreshing variety.

Having got his reader fairly into the calculus, the author finally confesses a weakness for the subject and adds a third chapter of 'academic exercises,' in which he treats the subject of the usual text-books, only in a different order and briefly, but nevertheless including differential equations, Bessel's functions and spherical harmonics.

Even the student who has already studied the calculus in the usual systematic form will profit by traversing it with the author; and to the engineer the book must be very useful. The lecture style in which it is written often makes the subject more attractive. It also sometimes carries away the author, in an excess of enthusiasm, into expressions of opinion which are not to be taken too seriously nor yet to be 'skipped,' as the author advises in the cases of difficult passages.

F. N. Cole.

Columbia University.

SOCIETIES AND ACADEMIES.

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO, NOVEMBER, 1897.

A New Human Tænia (Tænia confusa, Ward). —The new form has much of the slender appearance and delicate structure of *Tænia solium*, but as regards the size of the proglottids is even larger than *Tænia saginata*. The segments are of almost uniform breadth and very narrow. In addition to a peculiarly constructed head, the worm presents many variations of bodily structure when compared with the ordinary forms. The sexually mature proglottids measure 4–5 mm. long by 3–4.5 mm. wide; the lobes of the ovary are kidney-shaped and two or three times as long as broad; the genital pore is extremely shallow; in all of which respects it differs markedly from either *T. saginata* or *T. solium*. A short distance from the exterior the vagina is provided with a very distinct sphincter muscle. A similar structure was found also in preparations of *T. saginata*. Such a muscle, heretofore, was thought to exist only in other than human Tæniæ. Just before the vagina reaches the receptaculum seminis it becomes highly modified and, unlike that of *T. saginata* or *T. solium*, is encircled by a number of small sphincter muscles. As regards the male reproductive system, the testes are smaller than those of *T. saginata*, and a distinct seminal vesicle is present. The terminal or ripe proglottids are of an extreme length, measuring 28–35 mm. long by only 4–5 mm. wide. They never have the peculiar pumpkin-seed shape so characteristic of *T. saginata*, but are of constant transverse diameter, flaring slightly at the posterior end to form a broad base of attachment for the succeeding proglottid. The branches of the uterus number from 11 to 14, and are divided more or less arborescently, resembling those of *T. solium* somewhat in general configuration. The eggs are without pyriform apparatus and measure about 30 by 39 micra. The longitudinal nerves run in strands of from three to five down each side of the body; near the pore the strands separate, part going ventral and part dorsal to the genital ducts. The longitudinal muscles are continuous throughout the body.

M. F. Guyer.

Some Features of the Oögenesis of Sternaspis. —The egg-cells arise in the manner described by Vejdovsky from the peritoneal epithelium of certain blood-vessels, forming a single pair of distinct ovaries, each surrounded by a fold of the peritoneum and opening to the exterior of a distinct oviduct.

As the egg-cell grows a pedicle is formed beneath it, and in this appears a loop of the blood-vessel as described by Vejdovsky. The end of the loop enters the egg-cell.

In early stages the egg-cell contains a large nucleus with prominent nucleolus and reticular cytoplasm. As growth proceeds the cytoplasm begins to assume a radiating structure, centering about the end of the vascular loop. The first yolk-granules deposited appear in the portions of the egg farthest from the point of attachment. The radiate arrangement of the cytoplasm becomes more distinct as yolk is formed, and the region immediately surrounding the vascular loop stains very deeply.

The egg is now pear-shaped, hanging from its stalk with the nucleus in the broader end sur-

rounded by large yolk-spheres. As the egg gradually fills with yolk the cytoplasmic radiations become less conspicuous and shorter. Finally, the egg-cell becomes filled with yolk-spheres, except a small region about the vascular loop, which contains a reticular cytoplasm, from which fine threads pass out among the yolk-spheres. The nucleus is at the opposite end of the oval egg and is almost surrounded by yolk.

Now the vascular loop disappears; the egg, surrounded by its membrane, becomes detached from its pedicle, and the point of attachment becomes the micropyle, lying just over the small cytoplasmic area.

The temporary radiate arrangement of the cytoplasm, resembling in many respects an aster, is apparently closely connected with the deposition of yolk, and with the fact that the egg receives its nutriment from one end, *i. e.*, from the vascular loop.

C. M. CHILD.

Observations on the Cytogeny of Annelids with 'Equal' Cleavage.—Podarke obscura. The segmentation is of the so-called 'equal' type. At the 8-cell stage all the cells are equal in size, and up to the 56-cell stage there are no differences between the quadrants. Five groups of 'micromeres' are formed, which have the same history as the correspondiug groups described for other annelids, but the cells d^2 (x) and d^4 (m) are no larger than the other cells of the corresponding quadrants. The median plane of the embryo forms an angle of approximately 45° with the first two cleavage planes.

Bilateral symmetry in the embryo is produced by the formation of a small cell ($x^{1.2.}$) at the 64-cell stage; by the bilateral division of one of the 4th group of micromeres to form the mesoblast, and by the appearance of a bilateral cross at the upper pole, these two latter divisions occurring immediately after the 64-cell stage. From now on the original radial symmetry is rapidly lost.

A few observations on other annelids follow.

Lepidonotus sp. Here are formed the regular number (5) of groups of micromeres, the cell $x^{1.2.}$, and the bilaterally symmetrical cross.

Sthenolais picta. The cross furrow takes and retains the position characteristic of the other annelids, and the cell $x^{1.2.}$ is formed at the usual time and place.

Hydroides dianthus. Five groups of micromeres appear and one of the 4th group divides bilaterally at the surface (mesoderm?). The primary trochoblasts divide but once, thus forming a primary prototroch of 8 cells instead of 16, as in other annelids.

A. L. TREADWELL.

In addition to the above papers the following reviews of recent literature were given during the month: 'The Yolk-Nucleins in Birds and Mammals' (Mertens), F. L. Charles; 'The Correspondence in the History of the Germ Cells in Plants and Animals' (Häcker), Miss M. M. Sturges; 'The Development of the Excretory System of the Myxinoids' (Mass), Miss E. R. Gregory.

NEW YORK ACADEMY OF SCIENCES—SECTION OF BIOLOGY, DECEMBER 13.

IN a paper entitled 'Considerations on Cell-Lineage, based on a Re-examination of some Points on the Development of Annelids and Polyclades,' Professor E. B. Wilson presented observations regarding the origin and relations of the mesoblast in annelids and polyclades which illustrate the fact of ancestral reminiscence in cell-lineage. In some of the Annelids (*Aricia*, *Spio*, *Nereis* and others) the primary mesoblasts have not been properly so-called; for before giving rise to the mesoblast-bands they bud forth cells that may be, in some cases, traced into the wall of the archenteron. In *Nereis* not less than six or eight such cells are formed; these become pigmented, wander into the interior, and finally give rise to the posterior part of the archenteron. In *Aricia* and *Spio* only a single pair of corresponding cells is formed, and they are so small as to play a quite insignificant part in the building of the body. A comparison of these results with those of Conklin on *Crepidula* indicates that the mesoblastic pole-cells of annelids and mollusks are to be regarded both historically and ontogenetically as derivatives of the archenteron, and that the rudimentary cells of *Aricia* and *Spio* are

vestiges or ancestral reminiscences of such origin.

A re-examination of the cell-lineage of a polyclade, *Leptoplana*, shows that, as in the annelid or gasteropod, all of the first three quartets of micromeres give rise to ectoblast, while the second quartet gives rise also to mesoblast, each cell of this quartet segmenting off three ectoblast-cells and then delaminating a large mesoblast-cell into the interior. The third quartet apparently gives rise to ectoblast alone, though the possibility of its producing mesoblast is not excluded. The four macromeres remaining give rise to the archenteron, as Lang describes, first dividing to form four basal cells (corresponding in origin and position with the four basal entomeres of annelids and mollusks) and four much larger upper cells which correspond to the fourth quartet of micromeres in annelids and mollusks. The posterior of these cells always divides before the others, sometimes equally and symmetrically, as in *Discocœlis* (Lang), but more often unequally. The cells thus formed give rise to a part of the archenteron and not, so far as can be determined, to mesoblast.

These observations show that the mesoblast of polyclades is of ectoblastic origin, and they suggest that the origin of mesenchyme-cells from the second (*Unio*, *Crepidula*) or third (*Physa*, *Planorbis*) quartets in gasteropods may be a vestige or ancestral reminiscence of the mesoblast formation in the polyclades. They suggest, further, that the mesoblast-bands (entomesoblast) of annelids and mollusks may have been historically of later origin than the mesenchyme (ectomesoblast)—a view which harmonizes, broadly speaking, with that of Meyer—and that the two symmetrical entoblast-cells, into which the posterior member of the fourth quartet divides in the polyclade may represent the prototypes of the entomesoblasts of the annelids and gasteropods.

Mr. Crampton briefly reviewed his observations on the early history of the egg in *Molgula manhattensis*, as follows: The author emphasized the fact that development begins not with the cleavage or fertilization processes, but even before. From the origin of the primary oocyte until the final assumption of the adult form, there is a continuous series of developmental changes, each stage being based upon the preceding one and conditioned by it.

The growth of the primary oocyte and the formation of the yolk were considered at some length. A true 'yolk-nucleus' arises, as the author believes, from the nucleus, and this by continued growth, and later by fragmentation, gives rise to very small spherules which later, by enlarging, form the yolk-spherules. The yolk-nucleus is an albuminous body closely allied to, if not identical with, the yolk or deutoplasm. This was indicated by a large number of microchemical tests. The yolk-nucleus at a very early stage of the egg was also shown to be the only albuminous body in the cell, for the rest of the extra-nuclear part of the cell is almost exclusively composed of pseudo-nucleinic substances. Evidence was cited which indicated that the yolk-nucleus was formed by the nucleus, and that it enlarged by constant additions to it from the nucleus.

The more important results of a study of the maturation and fertilization processes might be briefly stated, although a fuller account will appear in the published paper. The first maturation spindle arises entirely from the germinal vesicle. It is peculiar in that it is barrel-shaped and does not, as far as can be determined, bear at either end centrosomes or asters. The first polar-body receives sixteen chromosomes, while sixteen remain in the egg. The second maturation spindle is also barrel-shaped and is also devoid of centrosomes and asters. Eight chromosomes remain in the egg. The sperm entrance was described and evidence was brought forward to show that the centrosomes of the first cleavage figure were derived from the sperm.

The spindle of the first cleavage figure appears to be formed from the segmentation nucleus, there being no 'central spindle' extending between the centrosomes. The spindle itself was shown to be barrel-shaped, the daughter chromosomes reforming into a vesicular nucleus at the ends or heads of the barrel. A 'zwischen-korper' also arises, as in the maturation stages, by a concentration of the spindle fibres at the equator of the figure. After the reformation of the daughter nuclei, and after division of the cell-body, the paired daughter centrosomes and asters diverge. The

daughter nucleus later moves up between the asters and prepares for the next division. Comparative independence and parallelism of the processes undergone by the centrosomes and asters, on the one hand, and those of the nuclei, on the other, become very strongly probable. Detailed evidence in support of the above points will be given in the published paper.

GARY N. CALKINS,
Secretary of Section.

TORREY BOTANICAL CLUB.

THE first paper of the evening was by Mr. Marshall A. Howe, 'The Genus Anthoceros in North America,' and was illustrated by drawings and specimens. The paper, which will soon appear in print, described three new species and reviewed those before known. Mr. Howe also indicated the intermediate position of Anthoceros between the Hepaticæ and Musci. The antheridia arise within the thallus as nowhere else among Bryophytes; and the archegonia finally become immersed within the thallus, though not endogenous in origin. The sporophyte differs from all other hepaticæ in having stomata and assimilative tissue on the capsule wall, in the presence of continued growth at the base, and in the elongated two-valved capsule. By the bryologist C. F. Austin, of Gloucester, N. J., the cognate genus Notothylas was united with Anthoceros; but it lacks stomata and differs in the form, direction and position of its capsule. Austin's herbarium was sold in England, and now belongs, in part, to the bryologist Pearson, and in part to Owens College, Manchester.

Discussion by President Brown and others followed. Dr. Underwood remarked that he had known Notothylas spores, unlike those of Anthoceros, to germinate without resting-period. *Anthoceros lævis* he finds among the hemlocks at the Botanic Garden at Bronx Park, and elsewhere in moist, flat, sandy and grassy land, fruiting August to November. In California, said Mr. Howe, they occur on banks and in springy places, beginning to fruit in February and shrivelling in May. One of the new species of the California coast is found by Mr. Howe to develop curious globose storage-bodies serving as food-reservoirs to carry the plant over the dry season.

The second communication was by Dr. T. F. Allen, entitled, 'Contributions to the Japanese Characeæ,' composed, in fact, of four papers, soon to be printed, descriptive mainly of certain Japanese Nitella forms displaying interesting correspondences with our own. Dr. Allen then exhibited numerous mounted specimens and etchings and discussed the taxonomic characters. Spore-characters, though important, are not to be relied on exclusively. Measurements of any one species prove very constant. In some the form of the mucro terminating each ray is decisive. The spores afford specific characters both by their arrangement and their markings, as shown by the $\frac{1}{12}$ or $\frac{1}{15}$ immersion lens. Their reticulations are very constant. The spirals which invest the spore are very early formed from the five bracts which form a cup about it and soon become spirally twisted, as all parts of the Characeæ do, and as the protoplasm current does even before its cell has become twisted. Discussing their life-history, Dr. Allen said that the Characeæ increase in part by nutrition dependent on absorption from their radicals. Pluck a Chara with the greatest care to avoid breaking these short unicellular roots, and yet the plant will finally die after the lower cells have yielded up their contents toward the maintenance of the others. *Chara coronata*, the finest of all in showing circulation, survived in his aquarium half a year without any rooting. *Nitella flexilis* will, however, root in the aquarium, seed, germinate and make a protonema, which divides immediately into an upward ray-bearing axis and a descending root-bearing portion.

In answer to remarks by Dr. Underwood and by Professor Burgess, Dr. Allen described the peculiar increase of the plant by absorption of water and by decomposition of sulphuretted hydrogen, occluding oxygen. The spore-shell, formed by thickening and calcareous development of the cell-walls of the enveloping bracts, hardens so as to survive as part of the rock through several geological periods. The aberrant genus Colcochæte among green algæ suggests the Characeæ, in tending to form a spiral around a spore. Chara resembles certain other

algæ, as some Polysiphonias, in forming a cortex by developing a layer of cells on its surface. The latter small cells absorb mineral matter, especially silica and lime. The Characeæ are important purifiers of water by means of this surface absorption. They are also interesting as examples of the great length to which it is possible for a single cell to develop—sometimes reaching 12 feet.

EDWARD S. BURGESS,
Secretary.

MEETING OF THE AMERICAN CHEMICAL SOCIETY.

THE regular meeting of the New York Section of the American Chemical Society was held on Friday evening, Jannary 7th, at the College of the City of New York, Dr. Wm. McMurtrie presiding.

Mr. G. E. Stone exhibited samples of manganese alloys of the following composition:

	Spiegel.	White.	Gray.
Total carbon	4.92	4.45	3.98
Graphitic carbon	.....	2.43	3.14
Silicon	1.94	1.51	3.25
Manganese	11.00	11.00	11.00
Phosphorus	0.04	0.04	0.04
Iron, sulphur, etc., difference	82.10	80.57	78.59
	100.00	100.00	100.00

The alloys are characterized by great hardness and strength, as compared with ordinary pig irons.

Mr. P. C. McIlhiney described a method of determining the resistance of electrolytes having the advantage of making readings at very short intervals. The more accurate method of Kohlrausch requires two minutes between readings, while by the method described a reading may be made every five seconds, which was necessary in the work for which the method was devised.

Professor Loeb gave a very exhaustive review of the speculations in regard to variations of the atomic weights, the theories of condensation, of the 'meta' elements and of ideas in regard to simpler forms of matter. He protests against the notion that any simpler conditions would result from assuming that all elements are a form of one element, and considers that the acceptance of a reasonable number of forms of matter is a decided advantage.

Miss Hitchcock reported experiments showing that nitrogen was given off from tungsten and molybdenum oxides when reduced in a current of hydrogen. On lowering the temperature the amount of nitrogen decreased and increased on again raising the heat. Argon and helium were not found. The results obtained on other oxides indicate that nitrogen is generally present and is considered as a cause of obtaining low atomic weights by the reduction method. Further results are promised.

DURAND WOODMAN,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE eighteenth anniversary meeting of the Biological Society of Washington, D. C., was held on the evening of January 7th. The subject of the presidential address, by Dr. L. O. Howard, was 'A Great Experiment in Economic Entomology: The Work of Massachusetts against the Gipsy Moth.' Both the practical and biological aspects of the work were considered. The address will not be published in full, but the practical portion will appear in Bulletin 10, New Series, Divison of Entomology, United States Department of Agriculture. The biological portion comprised a consideration of the interesting points which have developed in the course of the work of the committee of the State Board of Agriculture for Massachusetts, under the direction of the entomological adviser, Professor C. H. Fernald. The points especially considered were the analyses of the caterpillars fed upon arsenical poisons, the experiments upon rate of travel, amount and character of food, effects of starving, of heat and cold upon the larvæ, the occurrence of hermaphroditism, of polygamy and polyandry with the adults, the experiments upon the eggs, especially as to the effects of heat and cold, and the very important and interesting work done on the assembling of the adults. More detailed consideration was given to the biological interest attaching to the work as a whole, as an attempt to extérminate a species existing under the most favorable circumstances over a considerable extent of country.

F. A. LUCAS.