sembles temporarily the eye of a red-blind individual. In like manner temporary green blindness and violet blindness may be produced by fatiguing the eye with light of the corresponding color. Very remarkable results are obtained when the eye is fatigued, not by exposure to one of the fundamental colors of the Young-Helmholtz theory, but by an intermediate color, such as yellow or blue. In case yellow light is used it is found that the persistence of vision is increased for both red and green: *but that the persistence of vision for yellow light remains unchanged.* The article contains much that is of great significance in connection with theories of color vision. In the same number of the *Review*, Dr. W. P. Boynton, of California, discusses the Gibb's 'Thermodynamic Model in the case of a substance obeying Van der Waal's Equation'; while Dr. J. C. Shedd, of Colorado College, gives an analytical discussion of the various forms of curves that are presented by the fringes seen in the Michelson interferometer.

## *SOCIETIES AND ACADEMIES.*

### NEW YORK ACADEMY OF SCIENCES.

### SECTION OF BIOLOGY.

THE regular monthly meeting for December was held on the evening of the 10th, Professor C. L. Bristol presiding.

Professor Lloyd offered his resignation as Secretary of the Section, on account of his intended absence in Europe. On the motion of Professor Wilson, seconded by Dr. Calkins, a vote of thanks was tendered to the Secretary for his interest in furthering the work of the Section.

The following program then was offered:

G. N. Calkins: 'Some interesting Protozoa from Van Cortlandt Park.'

H. E. Crampton: 'Elimination in Lepidoptera.'

E. B. Wilson: 'The Chemical Fertilization of the Sea-Urchin Egg.'

Dr. Calkins stated that there were four genera of Protozoa which are usually regarded as intermediate forms between the classes of Protozoa were considered. These were: *Nuclearia*, intermediate between the Rhizopoda and the Heliozoa; *Mastigamoeba*, intermediate between Mastigophora and the Rhizopoda; *Multicilia*, intermediate between the Mastigophora and Ciliata, and *Actinobolus*, intermediate between the Ciliata and the Suctoria. The method of feeding in the latter form was also described for the first time. All these forms, together with 54 other genera and a great many species (100 to 150) were found in the waters of Van Cortlandt Park during the past fall.

The paper by Dr. Crampton was designed to be the first of a series dealing with the problems of variation and selection in Lepidoptera, and especially in the Saturnid moths. The particular questions here considered are as to the relative variability of eliminated and surviving pupæ and moths of *Philosamia cynthia*, and as to the relative variability of males and females. From a lot of 1,090 cocoons from a restricted locality, 310 living and 632 dead pupæ were obtained, the remainder being shriveled or abnormal larvæ and pupæ. The living pupæ were compared with an equal number of dead pupæ in reference to certain body-characters (length, length of bust, width, depth, frontal stature and sagittal stature of bust), and to certain characters of a typical organ, the left antenna (length, breadth and stature). It appears that the surviving males are slightly less variable than the eliminated males, and that the surviving females are far less variable. From the living pupæ 180 perfect moths were obtained. The males were from pupæ which were far less variable than pupæ producing abnormal moths; but the females were from relatively more variable pupæ, though the latter were much less variable than eliminated female pupæ of the preceding group. The paper will be published in full.

Professor Wilson presented the results of a study of the phenomena of development in the unfertilized eggs of *Toxopneustes* when treated with solutions of magnesium chloride by Loeb's method. The results confirm Loeb's conclusion that the embryos arising from these eggs are produced without fertilization by spermatozoa, conclusive proof being given in the fact that during cleavage the number of chromosomes is half the usual number, namely 18 instead of 36. The mitotic phenomena differ in many de-

tails from those occurring in fertilized eggs, but show a striking general parallel to them. The asters may be only two in number (cleavage asters), but as a rule there are many other asters (cytasters) that have no connection with the nucleus. Like the nuclear asters, however, the cytasters contain centrosomes and may progressively multiply by division. Cytasters and centrosomes are formed also in enucleated fragments obtained by shaking unfertilized eggs to pieces before treatment by the magnesium solution, and these asters may likewise multiply by division.

These facts seem to leave no doubt of the formation of functional centrosomes *de novo* and independently of the nucleus. Evidence was adduced to show that the asters may operate as centers of cytoplasmic division, independently of the necleus. It was also shown that the magnesium eggs show numerous gradations in the mitotic process between complete division and partial mitosis.

FRANCIS E. LLOYD,
*Secretary.*

ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science of St. Louis of December 17, 1900, forty-six persons present, the following subjects were presented:

Dr. O. Widmann read an account of the great St. Louis crow-roost, in which were embodied many facts concerning the life-history and habits of the common crow.

Professor F. E. Nipher gave an account of some of his recent results in positive photography. He has now found that hydrochinone baths of normal strength may be used. The formula given in each box of Cramer plates yields good results, if the mixed bath is diluted with water to one-third strength. The potassium bromide may be left out, and one drop of concentrated hypo solution must be added for each ounce of diluted bath. The hypo has a most wonderful effect. With the same bath, plates may be developed as positives, in the dark room or in direct sunlight. He had even started the developing of a plate in a dark room, where it progressed very slowly, but satisfactorily; continued the operation in diffused daylight in an adjoining room, and finished the operation in direct sunlight. The process was accelerated by the light, but did not appear to be otherwise changed by the change in illumination. The resulting picture could not be distinguished from those produced by ordinary methods. This picture was shown by means of the lantern.

A box of Cramer's 'Crown,' 'Banner' or 'Isochromatic' plates may have the plates individually wrapped in black paper, in the dark room or at night, and all the remaining work may be done in the light. A plate is taken from its wrapping into the lighted room and placed in the slide holder. After exposure it is taken out into the light and placed in the developing bath, and the picture is then developed in the light, and may be fixed in the light. Of course, during the changes the plate should be shielded from the light as much as is feasible, and the fixing bath may always be covered. But all the operations may be carried on without any dark-room conveniences that may not be secured even in the open fields.

When weak hydrochinone baths are used, the picture, when developed in strong lamp-light, or in sunlight, has at first a golden-yellow color. When left in the lighted bath for an hour and a half, it slowly darkens to a nearly normal shade, as the details come out more sharply. If the exposure has been correctly made, there will be no trace of fog. With stronger baths, the picture comes out in the normal time, and has the normal shade.

If the pictures are too dense, the remedy is to reduce the strength of the sodium carbonate solution, or to increase the amount of hypo in the bath. Very fine results are obtained with the sodium carbonate solution at half the strength given in Cramer's formula.

When the plate has been sufficiently exposed, a negative of the object can usually be seen upon the plate before development. With long exposure this image is very distinct. It fades out in the bath, and the plate becomes clear. The shadows appear strongly but indistinctly at first, and of a pink color, and the high-lights still appear white. The solution remains clear. Too much hypo will cause turbidity and a loss of detail.

When the plate is exposed in a printing frame

under either a negative or a positive, an exposure of half a minute to diffuse daylight is ample, with an ordinary negative. The plate may be over-exposed by placing it for a long time in direct sunlight, and it will then appear on development somewhat like an over exposed negative. This has not yet been tried with hypo in the bath.

Professor Nipher showed a preliminary diagram in which exposure and illumination of the developing bath were taken as coordinates. The zero condition was represented by a line, and the conditions for producing direct and inverted pictures were represented by areas.

He also exposed and developed, in a common bath, in the lighted audience room, negatives printed from negatives and positives printed from positives.

The possible value of radio-active substances acting upon the developing plate in place of or in addition to light was referred to as a most promising field for study.

Professor Nipher stated that he had done no work with the plates of other makers, since he found on trial that one such plate did not give good results with the treatment that had succeeded with the Cramer plates.

One person was elected to active membership.

WILLIAM TRELEASE,
*Recording Secretary.*

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO.

THE first meeting of the Quarter, October 17th, was devoted to a paper by Miss Mary Hefferan, giving the results of her researches on the variation of the teeth in the jaws of *Nereis*. This paper will appear elsewhere in full.

At the second session of the club, October 31st, Mr. R. S. Lillie gave an account of some experimental work upon the reactions of Arenicola-larvæ which was carried on by him during the last summer at Woods Holl. The following is a brief abstract of Mr. Lillie's paper:

In the swarming stage (in which three setigerous trunk segments are present) the larvæ are positively heliotropic and negatively geotropic, and in consequence collect at the surface of the water on the light side of the dish. After the fourth segment has appeared the cilia are lost, the larvæ settle to the bottom, and the heliotropism becomes negative. The heliotropic response is due to the rays at the blue end of the spectrum, the red rays being apparently inactive.

The normal reactions of the swarming larvæ are altered under the following artifically induced conditions: (*a*) rise of temperature of the sea-water, (*b*) dilution or concentration of the sea-water within certain limits, (*c*) alteration of the chemical constitution of the medium. Rise of temperature above 35° is followed by loss of heliotropism and a gradual settling of the larvæ to the bottom; on cooling, however, heliotropism and negative geotropism largely appear. In dilute or concentrated sea-water the heliotropism in a large proportion of larvæ is altered from positive to negative; the same happens in slightly acidulated sea-water (though the effect here soon passes off and positive heliotropism reappears) and also in artificial solutions containing NaCl, $CaCl_2$, and $MgCl_2$ in certain proportions.

Solutions of different salts affect ciliary and muscular movements in definite and characteristic ways. A fact of particular significance is that in the same solution one form of motility may be affected very differently from the other. Pure 5/8n NaCl solutions immediately arrest ciliary movement and cause a liquefaction and dissolution of the cilia; towards muscular movement its action is decidedly less injurious. The poisonous effect of the pure solution is, however, diminished by dilution, and also by the addition of small quantities of other salts, especially $CaCl_2$ and $MgCl_2$. Solutions containing *two* salts in favorable proportions preserve ciliary and muscular activities for considerable periods, each form of activity having its own characteristic optimum solution which differs from that of the other. Pure $CaCl_2$ solutions and pure $MgCl_2$ solutions, and their mixtures, quickly arrest muscular activity and cause the larvæ to become perfectly rigid within a few minutes; while ciliary movement may continue in these solutions in some cases for hours after muscular movement has ceased. The larvæ, although capable of swimming about actively in these solutions, quickly lose all power of heliotropic orientation as their power

of muscular movement disappears; and in a short time they become collected in small groups or clumps, as a result of their inability to effect the muscular movements necessary to disengage them from the contact and adhesion of other larvæ. The fact that ciliary activity can continue (in some cases for many hours) in solutions in which all muscular movement is impossible, proves that these two forms of contractility are essentially very different.

Solutions containing *three* salts in suitable proportions are much more favorable than those containing only two. In solutions of the composition 40 cc. 5/8n NaCl + 55 cc. 10/8n $MgCl_2$ + 5 cc. 10/8n $CaCl_2$, larvæ may remain living and capable of growth for so long a period as two weeks. Mixtures of the above three salts are the most favorable; the presence of KCl is injurious since potassium acts as a specific poison on muscular tissue. The three most essential metallic ions for the life-activities of these organisms are apparently Na, Ca, and Mg; K in very small proportions is probably also necessary.

On analysis of the normal swimming movements of the larvæ it appears that ciliary and muscular movements play separate and independent parts. Propulsion is effected exclusively by the action of the cilia, while heliotropic orientation is a purely muscular phenomenon with which the cilia have nothing directly to do. That this is so is proved (1) by direct observation, which shows that the cilia never exhibit a greater degree of activity on one side of the body than on the other, while the muscles of the more strongly illuminated side always show stronger contractions than those of the other; (2) by the fact of heliotropic orientation of the larvæ in later stages after the cilia have disappeared; and (3) by the fact that all power of heliotropic response is lost in solutions that remove muscular contractility without at first interfering with ciliary movement.

C. M. Child,
*Secretary.*

## Zoological Journal Club of the University of Michigan.

The meetings of November 6th and November 13th were occupied by Dr. H. S. Jennings with an account, accompanied by demonstrations, of his researches on the activities of unicellular organisms. By means of the arc light, stereopticon and projecting microscope, with an intervening alum cell to cut out the heat, the living organisms were projected on the screen, and their reactions to various stimuli could be observed by those present. *Paramecium* thus appeared three inches long, and its minute structure, even to the cilia, was visible.

The collecting ('positive chemotaxis') of *Paramecia* about a bubble of $CO_2$ and in solutions of mineral acids was shown; also the spontaneous collections formed by the organisms, owing to the presence of $CO_2$ excreted by themselves. 'Negative chemotaxis' toward salt solutions was shown in the same way. Attention was then directed to the mechanism of the reactions, and it was pointed out that there was no orientation of the organisms either in collecting in the acids or in the negative reaction to salts. By throwing on the screen a slide of *Paramecia* with a small ring marked on the outside of the cover-glass, it was shown that in their swift roving movements at least ten *Paramecia* per second crossed this ring; hence that if any method could be found of keeping in the ring those that crossed it by chance, the area would soon swarm with the *Paramecia*. A drop of weak acid was now introduced beneath the marked ring; it could then be observed that the animals swam into the area just as before, but that on coming to the outer boundary of the area, they were turned back. Hence every *Paramecium* entering by chance remained in the area—swimming rapidly from one side to the other—and in a short time a dense collection was here formed ('positive chemotaxis').

To show the exact mechanism of the reactions, an organism having a more differentiated structure, so that its movements could be more easily followed, was thrown on the screen. For this purpose *Oxytricha* was used. The differentiation of right and left sides in this infusorian was pointed out; then as the individuals approached a source of stimulus, the lecturer predicted, by pointing, in which direction the animal would turn on arriving at the stim-

ulus. The predictions were always fulfilled, since the animals always turn to their right when stimulated.

In the same way *Paramecia* always turn toward the *aboral* side when stimulated. These animals have thus a definite 'motor reaction' to almost any stimulus—consisting of a dart backward and a turning toward a *structurally defined* side. The collection of the *Paramecia* in the drop of acid is due to the fact that the passage from the acid to the water acts as a stimulus to produce this 'motor reacton.' This prevents them from leaving the acid, and a dense collection is soon formed.

The collecting of *Chilomonads* in acetic acid was shown. The essential identity in character of 'positive chemotaxis' or 'positive chemotropism' with 'negative chemotaxis' or 'chemokinesis' was demonstrated by showing that whether we get the one or the other depends on the relative arrangement of the two fluids. If the *Paramecia* or *Chilomonads* were in water, and a drop of acid was introduced, a dense group was quickly formed in the acid ('positive chemotaxis'); if on the other hand the organisms are in acid and a drop of water is introduced, the latter remains quite empty. If now the organisms were in water and a drop of salt solution was introduced, the drop remained empty ('negative chemotaxis,' or 'chemokinesis'); if the organisms were in salt solution and a drop of water was introduced, they swarmed into the drop of water, as previously into the acid. Passage from the water to acid does not cause the 'motor reaction,' while passage from the acid to the water does, hence they collect in the acid; passage from the salt solution to the water does not cause the reaction, while passage from the water to the salt does, hence they collect in the drop of water.

Many other demonstrations were given, and the significance of the results in simplifying the 'psychology' of these organisms, and in their relation to current theories of tropisms or taxis was discussed. Similar results to those set forth were stated to have been obtained with certain Metazoa also.

H. S. JENNINGS,
*Secretary.*

## *DISCUSSION AND CORRESPONDENCE.*

### UNAUTHORIZED NEWSPAPER REPORTS.

IN view of the fact that a number of daily papers have printed reports concerning alleged or real experiments of mine I wish to state:

1. That none of the statements printed in the newspapers have been authorized by me.

2. That whatever I may have to say about my work will be published in scientific journals.

JACQUES LOEB.

UNIVERSITY OF CHICAGO.

### AN APPEAL FOR ASSISTANCE.

TO THE EDITOR OF SCIENCE: A letter received from Mr. R. W. Garner, dated from Sao Thomé, West Africa, November 26, 1900, gives rather painful news of that intrepid explorer in the jungles of West Africa. Relying upon his remarkable powers of endurance and his simple habits of life, Mr. Garner started on this expedition with very limited means and an inadequate outfit. It seems that on this occasion he was overcome by the jungle fever, and the unexpected expense incurred by a month's sickness has exhausted his resources. He does not ask for help, but states that since he is already in a country where few men would care to venture, it seems as if some institution might like to send him a moderate sum of money, in return for which he would collect ethnological and zoological material, and at the same time could continue his own investigations. This is certainly a good opportunity, and any institution that can take advantage of it would at the same time be rendering assistance to a worthy explorer who is deserving of help in his undertaking. It will be necessary to secure Mr. Garner's services at once, since it is evident that if he does not receive some substantial cooperation, he cannot continue his researches. Any communication should be sent direct to Mr. R. W. Garner at Sao Thomé, West Africa.

F. W. PUTNAM.

PEABODY MUSEUM OF ARCHEOLOGY AND ETHNOLOGY, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

## *CURRENT NOTES ON METEOROLOGY.*

### RAINFALL OF NEW SOUTH WALES.

THE 'Results of Rain, River, and Evaporation Observations made in New South Wales