spines vary considerably in number on individual specimens, but the *average* number on specimens from salt water from different localities is quite constant, being about thirteen. When this shrimp is found in *brackish water*, however, the averages from different localities vary considerably, and *are always less* than the salt water average. In water which was nearly fresh, we have found the average to be as low as 9.61. Moreover, the decrease in the average seems to be in proportion to the decrease in density. This seems to show that such a character as rostral spinosity may be so correlated with the economy of the animal, that such a factor as salinity may determine it. The experiment of putting the animals from salt water directly into fresh water failed to show that those whose average number of spines was the least, had the greatest resistance capacity. Hence it is suspected that the direct action of environment, and not natural selection, is the method by which the evolution to the brackish-water form is accomplished. This question can be settled only by *rearing* the salt-water form in fresh or brackish water. The decrease in spinosity of the brackish-water form makes it seem probable that our fresh water species, *P. exilipes*, has been derived from *P. vulgaris*. The two species are very similar and, at least in respect to rostral-spinosity, intergrade perfectly; for the averages in *exilipes* are found to vary from 8.53 to 10.11, while *P. vulgaris*, as shown above, may have as low an average as 9.61. Experimentation may also throw light on the question as to whether *P. exilipes* has arisen as a variety in one place, and later spread, or has originated in different places under a common factor of environment—lessened density. In one case where the two forms were found inhabiting the same river (The St. Johns, Fla.), they were separated by a distance of only thirty miles, at most.

Variations and regeneration and Synapta Inhaereus.

The characters of this holothurian as described in systematic works, were subjected to quantitative analysis. The standard deviation, mean, mode and coefficient of variability were determined for 850 variates of the anchor and anchor-plates, 13 variations from the typical anchor and 20 variations from the typical anchor-plate were described. The typical anchor prevailed in 96.6% of the variates and the plate in 61.5%.

The specimens examined from Beaufort and Naples showed only one type, that of the described anchor and three types of plate with an adherence of $95\frac{3}{4}\%$ to the typical form. The specimens from southern waters are therefore least variable while the striking divergence is shown in the northern collections from Long Island, and Woods Holl with 18 types of plates, with 8 types of anchors showing spurs of various kinds, there is shown a tendency toward a place-mode at Lloyds Harbor, Long Island.

In one specimen from Centre Island, Cold Spring Harbor, Long Island, 61 3-7% of the variates belong to another than the type-pattern. Similar variations in the number of tentacles with their relation to the normal symmetry were noted. The mode of distribution of digits is three on the dorsal and ventral sides, respectively.

Nine out of 17 experiments on regeneration of the body and tentacles were successful.

The effect of strychnine on the unfertilized eggs of the sea-urchin: T. H. Morgan.

When the unfertilized eggs of *Arbacia* are placed in sea water containing strychnine they will begin to segment in the course of three or four hours. Strychnine, either as an alkoid or as a sulphate, produces the same effect; the solubility of the latter being nearly a hundred times greater than

that of the former. Saturated solutions were used. The eggs divide usually into a larger and a smaller part and the segmentation may continue through several subsequent divisions. The result is the same whether the eggs are left in the solution or whether transferred after two to three hours to sea water.

A certain time is necessary to start these changes in the eggs. Eggs left for one hour in the solution showed little subsequent segmentation, and even after one and a-half hours sojourn in the solution, only a few of the eggs divided after being returned to sea water. Richard Hertwig had shown that if the unfertilized eggs of a sea-urchin are put into sea water containing strychnine, that after a time the nuclear wall breaks down, a nuclear spindle forms around the chromosomes, and after division of the latter, a new nucleus reforms. My own results show that a nearly similar change takes place in *Arbacia*, but the chromosomes of many eggs separate after division and make two (or more) new nuclei. If this happens, a subsequent division of the protoplasm takes place.

The changes brought about by the strychnine have many points of resemblance to those that take place in the unfertilized eggs acted upon by certain salt solutions: magnesium, sodium or potassium chloride. In the latter instances I have tried to show that the transportation of the chromosomes is brought about by the astrospheres that appear in the egg and the number of new cells that form is, in general, in proportion to the number of astrospheres that are present in the egg. The latter being more numerous, produce a wider distribution of the chromosomes.

The absence of these astrospheres in the eggs acted upon by the strychnine accounts for the fewer divisions of the protoplasm in these eggs. All of these substances produce a slight shrinkage of the egg and it seemed not improbable that the cleavage of the egg might be the result of the plasmolysis, especially since the fertilized egg also sets free water or some other fluid at the moment the spermatozoön enters. In order to test this possibility I tried the effect of different strengths of magnesium and sodium chlorides—percentages ranging from those that do not affect the eggs to those that kill the eggs in a few minutes. The results show that isotonic solutions of these two salts produce very different results. The eggs will withstand a solution of magnesium chloride that was twice the strength of sodium chloride. This is the more surprising since the latter salt exists in sea-water in nearly ten times the quantity of the former.

The results also show that it takes a weak solution very much longer to act than a stronger one. The length of time being out of all proportion to the plasmolyzing effect of the solution. Further, a solution so strong that it will kill the eggs in half an hour, will cause the eggs to divide in several parts if they are left in the solution for five minutes and then transferred to sea-water.

In a previous paper I have compared the action of these substances to the action of stimuli on a nerve or a muscle. A large number of very different kinds of stimuli will start a nerve-impulse or a muscular contraction, the result depending more upon the structure of the living part than upon the stimulus employed. The unfertilized egg of the sea-urchin is likewise in a state of unstable equilibrium prepared to undergo a definite series of changes along given lines. These changes can be started in several ways, and resemble more or less perfectly the changes following fertilization, but I believe it would be as erroneous to compare the action of these substances directly with the process of fertilization as it would be to affirm that the action of a

sudden blow on a muscle producing contraction is the same as the normal nerve impulse received through the nerve. The result is more or less the same because the same mechanism is set to work in the muscle or in the egg, but it would be misleading to infer that, therefore, the stimuli are themselves alike because they produce nearly similar results.

Reissner's fibre in the canalis centralis of vertebrates. Porter Edward Sargent.

Reissner in 1860 described in Petromyzon a cylindrical rod or fibre lying in the canalis centralis. His discovery was confirmed three years later by Kutschin who named it Reissner's fibre. Its presence has since been noted in a considerable number of fishes by three other investigators. By these it has been generally considered an artifact formed by the coagulation of the cerebro-spinal fluid.

Researches carried on during the past year has proved it to be a continuous fibre extending through the whole length of the canalis centralis and into the brain ventricles, and constituting an integral part of the central nervous system of *all* vertebrates.

As its posterior end Reissner's fibre gives off fine processes which pass peripherally between the epithelial cells forming the walls of the canal into the nervous substances of the cord. Anteriorly it extends forward through the fourth ventricle to the anterior region of the third ventricle, where after dividing several times each, division enters the torus longitudinalis posterior and ventral to the posterior commissure. Within the torus the divisions of Reissner's fibre divide many times, becoming eventually distributed to the ectal region of the optic lobes. In cross section the fibre shows a thin myelin sheath, and the central portion has a punctate appearance. Studniscka's recent deductions as to the nature of the fibre are shown to be incorrect and drawn from insufficient data.

The development in Amia and some other Teleosts has been worked out. Shortly after hatching some of the neuroplasts in the anterior portion of the optic tectum become differentiated, increasing greatly in size. By the second day after hatching these twenty to thirty cells send out processes which grow downward, penetrate into the third ventricle and growing posteriorly, coalesce to form Reissner's fibre. By the end of the second day this has grown posteriorly through the aqueduct of Sylvius and by the third day through the whole length of the canalis centralis.

The following papers were read by title:

'Ingestion of follicle cells by the ovarian ovum of the rat,' by Maynard M. Metcalf.

'Newly found parallels between dinosaurs and birds,' by Henry F. Osborn.

'Terminal nerve cells in the skin and fate of the lateral line organs in Amphibia,' by C. L. Herrick.

'The nervous apparatus in the saccus vasculosus in *Acipenser*,' by J. B. Johnston.

'The giant cells in the spinal cord of Catostomus,' by J. B. Johnston.

'A suggestion as to the meaning of the periodical degeneration which occurs in some compound ascidians,' by Maynard M. Metcalf.

'New observations upon the structure of Octonemus,' by Maynard M. Metcalf.

'New England species of Glossophonia,' by W. E. Castle.

'Notes on the tracheal system in *Neuroptera*,' by G. C. Scott.

'Demonstration of photomicrographs in cytology,' by Katharine Foot.

'A case of regeneration of the end of a human finger,' by W. E. Ritter.

'On the multiplication of arms in the twenty-rayed starfish *Pycnopodium helianthoides*,' by W. E. Ritter.