bers frequently fused into a common mass. The nuclear conditions in these large fusion-masses offer an interesting object for study.

At the end of a period slightly longer than in the normal development the ectoplasm became vacuolated and ciliated. By the action of the cilia the eggs often rotated rapidly in the water. In the largest fusion-masses cilia appeared only on restricted areas.

Certain of the phenomena of ontogeny are thus shown to be independent of cell-division. It may be expected that further study of the material and careful analysis of the results will aid in the understanding of the mechanism of the earliest phenomena of development.

In conclusion, acknowledgment was made to the aid received from the subsequent work of A. D. Mead and Jacques Loeb.

The Rate of Growth in Marine Invertebrata: A. D. MEAD.

Ingestion and Digestion in Hydra: ELLIOT R. DOWNING.

Many observers have noted that the mouth of hydra is capable of great expansion, so that it can swallow comparatively large animals. The mouth is not a simple circular orifice; a cleft runs out from the center of the peristome toward each arm, so that it is divided into as many lobes as there are arms, the lobes alternating with the arms. The circumference of the expanded mouth is therefore as great as the contour of this radiate figure. These lobes at the margin of the peristome are double the thickness of the ordinary body wall on account of the greatly increased length of their endoderm cell. They become thinner toward the mouth and also where they merge into the body wall below the level of the tentacles. They are traversed by longitudinal muscle fibers continued from the body wall.

Ingestion is followed promptly by digestive processes. Within a few minutes after ingestion certain gland cells become apparent in the endoderm. These cells contain a nucleus which rapidly enlarges and becomes granular. As noted in the digestive processes of higher animals, these cells are probably forming enzymes. They rapidly decrease and finally disappear as the ferment is discharged into the body cavity. These gland cells stain best with gentian violet after osmic-Merkel.

The digestive process is rapid. Last June I observed a good-sized hydra ingest a young carp 8 mm. long. Seven hours later, as determined by sectioning, no trace of this remained in the digestive cavity. The digested material is absorbed by the endoderm cells, which after a meal are gorged with food spheres; much of this material, especially the oil, is passed on to the ectoderm cells, where it is stored. The fatty substance accumulated at the periphery of these cells forms a layer of droplets which may be stained an intense black by osmic acid. It is these fat droplets which during life give to hydra its brown color.

The History of the Eye of the Blind Fish Amblyopsis: CARL H. EIGENMANN.

The history of the eye of *Amblyopsis* may be divided into four periods:

(*a*) The first extends from the appearance of the eye till the embryo is 4.5 mm. long. This period is characterized by a normal palingenic development, except that cell division is retarded and there is very little growth.

(*b*) The second period extends till the fish is 10 mm. long. It is characterized by the direct development of the eye from the normal embryonic stage reached in the first period to the highest stage reached by the *Amblyopsis* eye.

(*c*) The third, from 10 mm. to about 80 or 100 mm. It is characterized by a number of changes which are positive as contrasted with degenerative. There are also distinct degenerative processes taking place during this period.

(*d*) The fourth, 80–100 mm. to death. It is characterized by degenerative processes only.

The eye of *Amblyopsis* appears at the same stage of growth as in normal fishes developing normal eyes. The eye grows but little after its appearance.

All the developmental processes are retarded and some of them give out prematurely. The most important, if the last, is the cell division and the accompanying growth that provide the material for the eye.

The lens appears at the normal time and in the normal way, but its cells never divide and never lose their embryonic character.

The lens is first to show degenerative steps and disappears entirely before the fish is 10 mm. long.

The optic nerve appears shortly before the fish reaches 5 mm. It does not increase in size with the growth of the fish and disappears in old age.

The scleral cartilages appear when the fish is 10 mm. long; they grow very slowly, possibly till old age.

There is no constant ratio between the extent and degree of ontogenic and phylogenic degeneration.

The eye is approaching the vanishing point through the route indicated by the eye of *Troglichthys*.

There being no causes operative or inhibitive, either within the fish or in the environment, that are not also operative or inhibitive in *Chologaster agassizii* which lives in caves and develops well-formed eyes, it is evident that the causes controlling the development are hereditarily established in the egg by an accumulation of such degenerative changes as are still notable in the later history of the eye of the adult.

The foundations of the eye are normally laid, but the superstructure, instead of continuing the plan with additional material, completes it out of the material provided for the foundations. The development of the foundation of the eye is phylogenic; the stages beyond the foundations are direct.

Asymmetry in the Rattulidæ, and the Biological Significance of Asymmetry in some Lower Organisms: H. S. JENNINGS.

The Rattulidæ are a family of Rotifera having an unsymmetrical form. The body presents the appearance of having been twisted, so that primitively dorsal structures are on the right side at the anterior end, and on the left side at the posterior end. An oblique ridge on the dorsal surface passes from the rear forward and to the right, ending frequently in one or two teeth on the right side. It was shown that this twisted form is an adaptation to the method of life and behavior of the animals; they swim in a spiral, of which the twisted body forms a segment, and the oblique ridge marks the course of the spiral. The reaction to stimuli is also correlated with this form. It was further pointed out that such an unsymmetrical form is common among small organisms which swim in a spiral course and react to stimuli in the characteristic manner described in the paper; this is true for example of most of the free-swimming Infusoria. If radial symmetry be considered characteristic of a fixed life, bilateral symmetry of an active life in which dorsal and ventral surfaces have different relations with the substratum, we may on similar grounds distinguish an unsymmetrical or spiral type,