

we may call the primary process of digestion, enters into the condition of the spherical globules, each surrounded by its vacuole; and that these spheroids, gradually decreasing in size, are ultimately worked up into the so-called crystals\*.

To the further consideration of this and other questions raised I intend to return at length.

#### EXPLANATION OF PLATE XII.

*Fig. 1.* Amœba after treatment with gold chloride. *a*, refractive body (? micro-nucleus).

*Fig. 2.* Living Amœba. *a*, refractive body.

*Fig. 3.* Nucleus of living Amœba, showing its relation to the refractive body (*a*) when at rest.

*Figs. 4-6.* Digesting matter in successive stages.

*Figs. 7, 8.* Homogeneous spheroids contained in vacuoles.

*Fig. 9.* Concretionary matters in relation to the small vacuoles.

*Fig. 10.* Relation between the spheroids and the so-called crystalline bodies.

Figs. 1 and 2 drawn under Zeiss's apochromatic system, oc. 8 compens. obj. 1.4 homog. immers. Figs. 3-10 drawn under same objective, with substitution of oc. 18.

#### XIX.—On the probable Sensory Nature of the "Appendix" of the Antennæ of Coleopterous Larvæ. By CHARLES J. GAHAN, M.A., of the British Museum (Natural History).

MANY Coleopterous larvæ are provided with a remarkable structure which is situated upon the distal surface of the penultimate segment of the antennæ. Though this structure has been noticed by more than one writer on Coleopterous larvæ and has been described as an "appendix," an "appendicular joint," a "blunt tubercle," and in other terms, it does not seem to have attracted much attention. At least, no author, so far as I am aware, has attempted to describe its microscopical characters in detail.

Some observations that I have recently made upon the antennæ of the larva of *Pterostichus*—a genus of Carabidæ—have led me to believe that the so-called appendix is in reality a sensory organ. When the antennæ of this larva are examined under the microscope the appendix is seen as a tolerably conspicuous object projecting from the oblique outer (or posterior) surface of the distal extremity of the third segment, its transverse diameter being very little less than

\* Le Dantec has shown the vacuolar fluid of several Protozoa to be acid ('Annales de l'Institut Pasteur,' 1890, pp. 776-791).



that of the fourth or terminal segment. It consists of a short chitinous or semichitinous collar or stalk, supporting a cap composed of a thin transparent cuticular membrane, which appears to be of the same thickness throughout and to be lined by very small cells. The cap is in the form of a short cone with curved sides, and is strengthened at the base where it joins the collar by a narrow and thickened chitinous ring. Lying within the laterally expanded distal portion of the third segment, at a short distance from the base of the collar, I was able to recognize what seemed to me to be a ganglionic swelling of the antennary nerve, containing a number of nerve-cells from which fibres or rods were seen to extend into the collar. These fibres did not seem to pass beyond the chitinous ring, and were only visible when focusing between the upper and lower portions of the ring. In view of the probable auditory nature of the organ I tried to detect the presence of the characteristic auditory rods which are found to be associated with the auditory apparatus in other insects. My failure in this endeavour was perhaps due to the want of a sufficiently high microscopic power. I am inclined, nevertheless, to suspect that within the collar, and just below the ring, rods of this kind may be found. I was also unable to satisfy myself as to the nature of the contents of the cap, though it seemed quite evident that it contained no otoliths. Whether the ring supports a transverse partition is another point I could not satisfactorily determine, though the appearances were rather in favour of believing that it does. These, however, are points that will have to be settled by further investigation. The presence of a nerve-ganglion with fibres passing out to the organ will also, I admit, need confirmation. In the few preparations I was able to make nothing more was attempted than to clear the integument slightly before finally mounting the antennæ in balsam. I regret that, owing to lack of sufficient material, I could not proceed to examine the structure of the organ more thoroughly by means of staining and sectioning. This I hope to be able to do later on.

Should the organ eventually be definitely proved to possess a sensory function little doubt would, I think, arise as to its auditory character. From its position and the way in which it is guarded by some long stiff setæ it would be more or less prevented from coming in contact with external bodies; so that it would be almost impossible for it to function as a tactile process; while, on the other hand, its general structure seems to preclude the idea of its being an olfactory organ. There are, moreover, on the same distal surface of the third segment,



as well as at the apex of the antenna, a few very much smaller hair-like structures somewhat similar to those to which an olfactory function has been usually ascribed. One of these, in close proximity to the organ in question, and two at the apex have a shape somewhat like that of a hand-bell. The remaining two at the apex are more or less cylindrical, with rather blunt extremities. Another on the third segment is shorter and broader and seems to have the form of a truncated cone.

It may be mentioned, in conclusion, that the presence of the "appendix" is not confined to the larvæ of a few genera of beetles. According to the observations of Schiödte and of Chapuis and Candèze it seems to be characteristic of the larvæ of Carabidæ, of Chrysomelidæ, and of certain other large families of Coleoptera, and that, though usually placed towards the outer or posterior side of the distal surface of the penultimate segment, it is, in the Staphylinidæ, situated on the anterior side.

The only other species in which I have had an opportunity of examining it was one of *Telephorus*, in which it had the same relation and pretty much the same general structure as in *Pterostichus*, the chief difference being that the chitinous ring, instead of having a uniform width throughout, is narrow at one side and extends upwards, to reach its greatest width on the opposite side. It was first noticed in this larva by the late G. R. Waterhouse, who referred to it as a "process."

Considering, therefore, the widespread existence of this appendix amongst Coleopterous larvæ, and of its very definite localization on the penultimate segment of the antennæ, together with its rather peculiar structure, it seemed to me that some elucidation of its precise nature and meaning was desirable. And even should it ultimately be proved that I have been mistaken in my first observations upon it, there will be some justification for having directed attention to a structure which seems to have been hitherto almost entirely neglected.

XX.—*Classification of the Pelecypoda: Fischer's Families rearranged in accordance with Pelseneer's Scheme.* By B. B. WOODWARD, F.G.S., F.R.M.S., of the British Museum (Natural History).

THE classification of the Pelecypoda has been from the first a matter of great difficulty owing to their comparatively uniform structure.

The characters hitherto employed have been more or less



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