That peculiar organ of the female, the annulus, proves to be an essential secondary sexual character. The male passes the sperm into the cavity of the annulus of the female, and does not distribute it elsewhere. The annulus, then, serves as a sperm-receptacle, and thus corresponds to the similarly situated organ described by Bumpus as a sperm-receptacle in the lobster, *Homarus americanus*. The well-known hooks on the ischiopodites of the third walking-legs of the male serve to hold the two animals firmly together, and are necessary secondary sexual organs. They are hooked over the firm ridges on the basipodites of the fourth legs of the female.

The special instincts and actions of the male and female are complex, and are very accurately interadjusted to secure the deposition of sperm in the annulus. The male, at a definite stage in the process of conjugation, passes either the right or the left fifth walking-leg across below his thorax in such a way as to support and guide the first and second pleopods, or intromittent apparatus, and thus secure effective function.

In the only case in which eggs were laid the sperm was removed from the annulus by the female soon after laying; the eggs, however, did not develop; various conditions were abnormal.—*Johns Hopkins University Circulars*, vol. xiv. no. 119, p. 74.

The Breeding-habits of the Earthworms. By E. A. Andrews.

The only detailed and accurate account of the complex phenomena of mutual conjugation in earthworms is that given by Hering for the European *Lumbricus terrestris*.

In studying the much smaller *Allolobophora fœtida* I find that it conjugates beneath the surface, and cannot therefore be directly observed.

Momentary immersion in boiling corrosive sublimate or boiling water followed by Perenyi's liquid preserves the conjugating individuals in the natural position, so that they may be studied by dissection and by the serial section method.

This study shows that the process is essentially as in *Lumbricus*. The union is, however, a much firmer and more intimate one, each individual being almost completely enveloped by the clitellum of the other, and firmly fastened to it by a stout enveloping case of mucus.

An important anatomical difference—the fact that the sperm-receptacles of *Allolobophora* open on to the *dorsal* surface, and not on to the ventral surface as they do in *Lumbricus*—necessitates a change in our conception of the method of sperm-transfer. The peculiar muscular contractions of the clitellum described by Hering are obviously insufficient to explain the filling of these dorsal sperm-receptacles, and we must apparently suppose there is some aspirating action of the receptacles involved in the process.

Light is also thrown upon the question of the origin of the so-called spermatophores, or "penes" of the older writers.

The sections show that they are formed opposite the openings of the vasa deferentia. Each is a secretion of skin-glands poured out from the lips of the vas deferens, and adhering firmly to the body of

the opposite animal, about the region of the twenty-first somite. Each is filled with a mass of sperm that issues from the vas deferens.

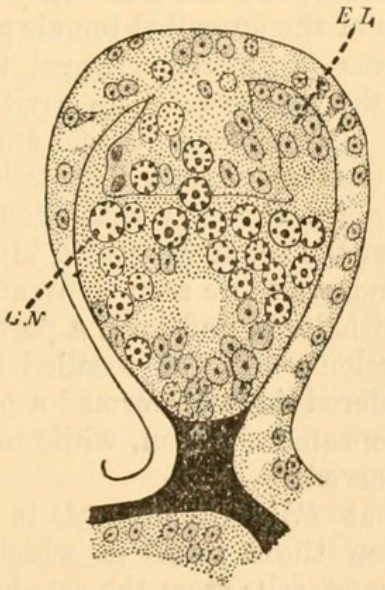
The idea advanced by Vejdovsky—that the spermatophores in *Lumbricus* are formed from the sperm-receptacles—does not hold in *Allolobophora*. A renewed study of *Lumbricus terrestris* by the above method of hardening *in situ* with boiling water and Perenyi's liquid shows that here also the spermatophores are opposite the vasa deferentia.

Until reasons for other views are given we may tentatively hold that the spermatophores in terrestrial Oligochætæ are not of the importance they assume elsewhere, but that they are to a large extent accidental results of secretions taking place during conjugation, and that they play no part in the subsequent processes leading to fertilization of the eggs.—*Johns Hopkins University Circulars*, vol. xiv. no. 119, p. 74.

Note on the Origin of the Bell-Nucleus in Physalia.

By Seitaro Goto.

At the beginning of the present academic year Dr. Brooks kindly placed at my disposal specimens of *Physalia*, which had been collected and preserved by him some years ago, with the desire that I should make a study of them, with special reference to the nature of the so-called female gonophores (Haeckel). I also had occasion to make observations on the development of the male gonophores; and it has turned out that there is a peculiar feature in the formation of the bell-nucleus to which attention has, so far as I know, never been called. In this short preliminary note I propose to describe the process briefly. In the accompanying diagram I have



Longitudinal section of a young male gonophore.
E L, entodermal lamella; *G N*, germ-nucleus.

represented a longitudinal section of an early stage in the development of the male gonophore. In this particular specimen the