organs of the Annelida. It is generally stated that in no case is there more than one pair of segmental organs in each annelidan segment, although the coexistence of segmental organs and generative ducts in the same segment in the Terricolus Oligochæta led Professor Lankester to regard two as the typical number of pairs for each segment. Dr. Eisig has now shown that in Notomastus more than one pair of segmental organs is frequently present in a segment, and that in *Capitella capitata* a plurality of these organs in each segment is the rule.

Moreover, in Capitella the number in each segment increases from before backwards. In adult Amphibia there are usually several segmental tubes in each segment, and the actual number in each segment also increases from before backwards. This fact has been used as an argument against the comparison of the segmental organs in Vertebrata and Annelida; but Dr. Eisig's observations prove that on this point at any rate there is no important difference between the organs in the two types.—F. M. B.

Bacteria as the Cause of the Ropy Change of Beet-root Sugar. —The so-called "Frog-spawn" of sugar manufacturers is a gelatinous formation, the origin of which has hitherto been explained in various ways. Professor Cienkowski has recently published at Charkow a memoir, in which he describes and figures a Bacterium as the cause of the remarkable and economically important phenomena connected with this alteration of sugar. According to Scheibler, the "Frog-spawn" is the protoplasm of the cells of the sugar-beet; according to Jubert and Mendes, this gummy substance is an aggregate of various organised ferments. Durin ascribes the "Frog-spawn" to a peculiar fermentation, due to the action of diastase on crystalline sugar, whereby the latter is broken up into cellulose (the spawn) and glucose.

Cienkowski's researches, carried on both in a sugar factory and by means of culture experiments, prove that the view put forward by Jubert and Mendes is essentially the correct one; the "Frog-spawn" is in reality a product of the vital activity of Bacteria; it is to these organisms, and not to diastase, that we must ascribe the decomposition of the crystalline sugar discovered by Durin.

The jelly of the "Frog-spawn" shows in its structure and development the closest resemblance to the *Ascococcus Billrothii* of Cohn (see this Journal, vol. XVI, p. 264, and Plate XX, fig. 1, for Cohn's description and figure of *Ascococcus Billrothii*). It is, perhaps, only a variety of that species, and in any case belongs to the same genus of Schizophyta, and may be named "*A. mesenteroides*."

A structure identical in every respect with the "Frog-spawn" of sugar factories arises spontaneously on slices of cooked beet-root which are kept moist with free access of air; such culture specimens differ from those of the factories only in their smaller size and less density of the jelly. The jelly-balls of the "Frog-spawn" consist of accumulations of jelly-masses or units, the so-called "Gallertkerne." These units are naked, without envelope; they are closely adpressed one to another, or are attached to one another in rows so as to form botryoidal loose or compact gut-like masses. By combination of such units spherical or irregularly-shaped lumps are produced, which again become compacted into larger masses. The jelly of the ultimate spheroids has a varying consistence—hard, elastic, sharply defined, or semi-fluid, with confluent outlines. It is soluble in concentrated potassic hydrate and in sulphuric acid; according to Durin, also in ammonio-cupric hydrate. Cienkowski failed to obtain this reaction, and only saw a faint blue coloration as the result of this reagent. Iodine with strong sulphuric acid produces no change in the jelly.

The most important part of the ultimate spheroids are the builders of the jelly—namely, the Bacteria embedded in it. In young examples they are present without exception; in older lumps difficult to detect. They exhibit the most varied forms, which are commonly known as Micrococcus, Torula, Bacterium-chains, Bacillus, and Vibrio. The common Bacteria pass into the Zooglœa condition, developing from colourless Leptothrix-like filaments (see this Journal, October, 1878) by a process of transverse subdivision and by the production of jelly around *both entire filaments* and the pieces into which they subdivide, and we find that the developmental history of the "Frog-spawn" is similar. Here too, as forerunners of the gelatinous growth, we find colourless filaments, which are often serpentine in form. The gelatinization of the Ascococcus-builders is easy to follow, especially when they are growing on very slimy substrata. But the "Frog-spawn" will also originate directly around isolated Bacteria. Such gelatinous ultimate spheroids, formed independently of one another come into contact with one another by further growth, adhere together and form miniature examples of the "Frog-spawn." The nearly allied *A. Billrothii* develops itself spontaneously on cooked and uncooked beet-root. The jelly which envelopes the Bacteria is in this case not so copious, and less refringent, than in the former species. In cultures kept fairly dry *A. Billrothii* attains an enormous size; it is easily visible with the naked eye. It forms brown or greenish heaps composed of numerous upgrowths; such examples differ in many respects from the forms described by Cohn and Billroth. The ultimate morphological elements into which they can be divided are, as in the former species, gelatinous spheroids with enclosed Bacteria.

All the properties of the "Frog-spawn," and nearly all the phenomena which accompany its formation, are in harmony with the supposition that these jelly-masses of the sugar factories are produced by Bacteria. Only in the extraordinary rapidity of their production (half an hour according to Feltz), do we come upon a difficulty, the explanation of which can only be looked for when we have a fuller knowledge of the developmental history of Bacteria. As a starting-point for further researches in this direction the following facts are of value:

(1) That in very viscid saccharine solutions all the Bacteria, without forming individualised Zooglœa-masses, are embedded in a common gelatinous substance which is coagulated by alcohol. (2) The capability possessed by the Bacteria of forming balls of this substance around themselves. (3) That a mechanical movement of the nutrient fluid appears to act favorably on the formation of the ball-like masses. A very viscid decoction of beet takes, as Cienkowski says he has often seen, a marked gelatinous consistence almost immediately when agitated. The mechanical movement of the beet-juice during the process of squeezing it out of the roots, will probably enough prove in this way to be one of the essential conditions of the rapid formation of "Frog-spawn."

Cienkowski's observations show then, that the "Frog-spawn" of the sugar-factories is no peculiar isolated phenomenon, but without any difficulty can be assigned a place in the category of the processes of jelly-formation so widely spread among the Algæ. —E. Ray Lankester.

Stein's 'Organismus der Infusionsthiere.'—The first volume of the third part of this great work has just appeared, consisting of 150 pages of letterpress and 24 folio plates. The third part is devoted to the Flagellata, and in the present volume we have an exhaustive history of the discoveries and writings of previous observers, from Ehrenberg to Carter, Busk, Williamson, Hicks, and James-Clarke. The plates are accompanied by full explanations; the systematic description of genera and species will follow. Forms allied to those described in Professor Bütschli's paper, an abridged translation of which appears in the present number of this Journal, are figured in profusion. A most remarkable form is the *Rhipidodendron splendidum*, a tube-making Flagellate, the tubes of which are aggregated in dense