

RESEARCHES ON THE GENERATIVE ORGANS OF THE OYSTER
(*O. edulis*.)*

By **P. P. C. HOEK.**

Last year the administrative commission of the zoological station of the Netherlands Society of Zoology took the initiative in the prosecution of researches relating to the anatomy, embryology, and biology of the oyster.

The anatomical portion of these investigations fell to my lot. My work was done in a small wooden building, the station of the society, which was in operation during the last two years in the vicinity of Bergen-op-Zoom. This town, situated on the northernmost arm of the Escaut, is also, so to speak, the center of oyster-culture in Holland.

My investigations from the first have related to the generative organs of the oyster. At the end of the first season I published a summary of the work done, in the sixth annual report of the zoological station. Up to the present time, after having again devoted some months to these studies, my results are so far developed that I publish herewith a summary of my investigations up to the end of the year. It will be published simultaneously in French and Dutch.

The most remarkable result of my researches during the past year has been to learn that the generative organs do not consist of localized glands, but that they extend over nearly the whole of the body mass; and also that they do not correspond in structure to the usual definition of such organs (lobulated or botryoidal glands) usually met with in lamellibranchiates. They are not separated on either side of the body from the integument, which in these regions is at the same time the mantle, consisting of a thin layer of connective tissue; at the fore part of the pericardiac cavity the dorsal and ventral portions, the right and left halves of the organ are in communication. Everywhere we meet with its branched ducts, which communicate with each other, and of which the inner walls are produced into cul-de-sacs directed towards the interior and vertically to the surface of the body. The epithelial cells of these cul-de-sacs are metamorphosed into eggs as well as into spermatogenic cells. Therefore it is the same cul-de-sac which produces at one time spermatozoa and ova.

The past year I had no luck in finding the generative openings. With the exception of M. Lacaze-Duthiers all the authors who have investigated this question have met with the same difficulty. To attain better results than my predecessors, I had employed the method of sections; I isolated portions of the ventral process of the body mass, where

* *Recherches sur les organes génitaux des Huitres.* Par M. P. P. C. HOEK. *Comptes rendus des séances de l'Académie des Sciences, Paris.* Novembre 6, 1882. Translated by JOHN A. RYDER.

the orifice is found which was observed by M. Lacaze-Duthiers. Unfortunately, the first series of sections very plainly showed the longitudinal cleft near the nervous commissure, which goes from the branchial ganglion to the branchiæ, the opening observed by M. Lacaze-Duthiers; but the series of sections was interrupted before this opening was prolonged into the genital canal. In another series, each preparation contained a section of the genital canal, which, however, resembled in every respect the branches (ducts) of the reproductive organ, but of which the special value was not recognized by me. It was from this that I was led to doubt the accuracy of the observation of M. Lacaze-Duthiers.

The investigations of the past summer demonstrated to me that it was not M. Lacaze-Duthiers, but myself, that was in error. The longitudinal cleft is prolonged as a duct, which is nothing else than the genital canal; this canal commences to branch very near its external orificé; these are the branches, which again divide and spread over nearly the whole surface of the body.

There is no trace of a genital papilla; the position of the genital opening is exactly the same on either side of the body, and it is also this same opening which serves for the organ of Bojanus; thus it is necessary to regard it as the urogenital opening. The efferent canals of the genital organs and the organ of Bojanus meet together near the common opening. We are, therefore, able to assert, with the same right that the efferent duct of the organ of Bojanus ends at that of the genital organ, or the contrary. Analogy has forced us rather to accept the latter view.

On the organ of Bojanus of the oyster, the literature is silent. In the excellent work of M. Lacaze-Duthiers (*Ann. des Sciences Nat.*, 4^e sér., t. IV, 1855) the common oyster has not been studied in this regard, and Von Jhering in 1877 (*Zeitschr. Wiss. Zool.*), in reviewing what had been published upon the organ of Bojanus in the mollusca, states that our knowledge is null upon this point as regards the oyster. My researches also led me to study this organ.

The organ of Bojanus is not developed as a very clearly marked structure; it is composed of membranous folds communicating with each other and with a cavity paved with ciliated epithelial cells, itself opening by a fine canal in the urogenital orifice. The cells of the wall of the canal are provided with vibratile cilia longer than those of the cells of the cavity. This cavity appears to be the same as that which, in the *mussel*, has been called the collecting canal by M. Sabatier. In the wall of this cavity commences a straight canal, which is continued nearly parallel to the genital duct and ends by opening into the so-called pericardiac cavity. This canal is clothed by cells bearing very long vibratile cilia which meet in the center and guard the passage against any object no matter how small. The membranous folds of the organ of Bojanus extend on to the walls of the pericardiac cavity, and upon the posterior part of the sides of the body, then into that part of the mantle

which joins the adductor muscle on its ventral side. In my report I will give a detailed description of the organ of Bojanus of the oyster.

If there is still the slightest doubt as to the hermaphroditism of the oyster, my researches have shown that, at the time when an oyster is sexually mature, it always functionates as a male as well as a female; it is, therefore, physiologically diœcious. And when the eggs of one oyster are fecundated by the spermatozoa of another, we need not be surprised if the contact of the eggs and spermatozoa takes place in the interior of the animal. Likewise the fact observed by M. Lacaze-Duthiers and by other authors, that the egg of the oyster is nearly always fecundated at the time of laying, is not surprising. The large number of males also, that is to say, individuals functionating as males, as stated by M. Davaine and M. Lacaze-Duthiers, explains itself. In the case of the oyster, as with most other lamellibranchs, the spermatozoa move and encounter the egg; "the water carrying the sperm in the currents produced by the ciliary movements of the internal surface of the mantle reaches the eggs;" that is, it gets into the genital duct.

I think this view of the question is the only one which gives a rational explanation of the facts.

NOTE ON THE ORGAN OF BOJANUS IN OSTREA VIRGINICA, GMELIN.

By JOHN A. RYDER.

In March, 1882, I first noticed what I supposed might probably be the organ of Bojanus of the American oyster, but I could not then investigate the matter, so that it was allowed to rest for the time being until a more favorable opportunity should occur to carry out more detailed researches. In November, 1882, I first began to make preparations to study the subject by means of sections, the only method by which it was believed possible to arrive at any valuable conclusions. Although I have not yet traced the structure in question in its relation to the pericardiac cavity and the openings of the generative organs, my sections show essentially much the same details of structure as have been described by M. Hoek. As that author observes, the literature of the subject is silent in regard to this structure in the oyster, and of the few allusions to the matter, one is by Huxley,* who says: "In *Ostrea* and *Teredo* the renal organ seems to be present in only a very rudimentary form." He then alludes to the researches of M. Lacaze-Duthiers. That it is present in a rudimentary form is the fact, as an examination of the structure in question has proved. In *Bronn's Klassen u. Ordnungen des Thierreichs, III, Malacozoa*, by Keferstein, on page 388, it is remarked, in effect, that the organ of Bojanus in *Ostrea* is present as a mere appendage of the ventricle. In "Forest and Stream," under date of No-

* Anat. Invertebrates, p. 411, New York, 1878.