ress Monroe for supplies. It seems that the stewards trusted somewhat to the resources of the places we expected to visit when laying in stores, and now find themselves running short.

We will go either to York River or Cherrystone to-night, being governed by the weather. We can do nothing with nets at the latter place, unless it is calm and smooth, as they are to be set in the open bay.

Should we find anything in York River it will be an inducement to try our fortune in Mob Jack Bay; if not, it will hardly be worth while.

Our present plan is to spend about three or four more working-days in the bay and Lower Potomac, and then return to Washington.

1.45 *p. m.*—Arrived at Fortress Monroe. Will leave about 2.30 for Cherrystone.

STEAMER FISH HAWK, *Tangier Sound*, *March* 2, 1882.

PRELIMINARY NOTICE OF SOME POINTS IN THE MINUTE ANATOMY OF THE OYSTER.

By JOHN A. RYDER.

There is a spacious segmentation cavity developed in the embryo which becomes the subdivided body cavity (schizocœl) of later stages.

Between the ecto- and entoblast the mesenchymal or mesoblastic tissue is developed, apparently, and for comparative embryological reasons, from the two former by proliferation, whereby the segmentation cavity becomes in part obliterated.

The mesoblast of the embryo, formed as above stated, is the tissue from which the mesenchyme or connective tissue of the adult is developed.

The blood channels, or canals, are developed in the mesenchyme; no specialized endothelial lining cells are ever differentiated, the mesenchymal cells form their immediate walls. An exception to this is found only in the structure of the anterior and posterior aortæ, the heart, and branchio-cardiac vessels, which have proper walls.

In some places the mesenchymal tissue is found to be spongy, its cells being built around complex anastomosing spaces for the blood. There is, therefore, a true schizocœl developed in the oyster; it has been formed as the mesenchyme has grown into the segmentation cavity, which has been subdivided in this way into hæmal canals and spaces as development proceeded.

The heart, as in the embryo fish, develops in the blastocœl or segmentation cavity, the pericardiac space being a remnant of the latter. (See Davaine, Recherches sur la Génération des Huitres. Mém. de la Soc. de Biologie IV, Paris, 1853. The foregoing statement is made upon the evidences afforded by the observations of the author above cited, on the development of the heart.)

The adductor of the shell and the radiating muscles of the mantle, as well as those of the heart, are derived from the mesoblastic or mesenchymal structures of the animal. The radiating muscular bundles of the adult lie just beneath the ectoblast, or epithelium, on the outer sides of the mantle leaves.

The muscular fibers of the walls of the heart are not striated, and decussate in every direction. The cavity of the heart is crossed in various directions by muscular bands, and a more or less complete muscular septum divides the ventricle in the median line. The heart is therefore approximately four-chambered.

The mesenchymal or mesoblastic tissues compose the great bulk of the body of the animal, and extend out into and form the greatest proportion of the thickness of the mantle, and also down into the branchiæ, where it forms thick transverse vertical septa between the outer compoundly ribbed walls of the branchial pouches lined with ectoblast. The mesenchyme also gives support to all the viscera, the stomach, liver, intestines, and reproductive organs being embedded in it.

The branchial blood-channels are also limited by the mesenchyme.

The mesenchymal cells are large, and will average $\frac{1}{500}$th of an inch in diameter. They inclose, in all cases, both in winter and summer, a large irregular nucleus, from which a complex network of intracellular fibrils radiate in all directions through the enveloping cellular substance. At one side of the nucleus there are always one or more accessory bodies perfectly globular. The mesenchymal elements are not fat-cells, as has been erroneously supposed by Brooks.

The mesenchymal cells are probably very hygroscopic, which explains why it is that oysters may be much swollen by osmose in a short time by immersion in water of less specific gravity than the sea-water in which they grew.

The mesenchyme may be regarded as the connective tissue of the animal. It corresponds morphologically to that structure in other types.

There is an apparent atrophy of the mesenchyme in the body-mass and mantle during the spawning season, with a great concomitant development of the reproductive follicles or tubules. In winter the reproductive follicles atrophy, when the mesenchyme again increases in bulk in the body-mass and mantle. These facts appear to show that the reproductive elements are derived from the mesenchyme by a transformation of its substance in which their follicles are embedded.

It is the great development of the mesenchymal substance in the autumn and winter, when the reproductive function is in abeyance, that constitutes the condition of the animal known to oystermen as "fatness." This word expresses the condition well enough, practically, but it is scientifically incorrect, since there is scarcely any fatty substance in the animal at any time.

In summer, when the reproductive organs are gorged with their products, their follicles are crowded together into contact; in winter, in their atrophied condition, they lie embedded in the superficial portion of the mesenchyme of the body-mass the same as in summer, but are much less developed, so as to appear in sections like a very open network of strands of very small nucleated incipient embryo cells, the connection of which may be traced into the now collapsed and internally ciliated branches of the oviducts. All the parts of the reproductive apparatus are therefore present in winter, but in an undeveloped condition.

The oviducts branch and spread over each side of the body-mass just external to the stratum of reproductive follicles and immediately beneath the mantle. They do not ramify through the substance of the reproductive organ, but lie externally to it. Their principal openings on each side of the body-mass pour their contents into the suprabranchial chambers on each side just below the muscle.

The liver is a diverticulum from the entoblastic walls of the stomach. The great bile ducts pass outward from the cavity of the stomach, and subdivide again and again, and end blindly in spacious ovoidal hepatic follicles, the simple walls of which consist of hepatic cells. The function of the liver is in all probability both excretory and secretory, and takes an all-important share in the processes of digestion.

The entoblastic wall of the intestine is folded inwards at one side for its entire length in a peculiar way, so that its lumen is more or less crescentic in cross section.

There are neither annular nor longitudinal muscular fibers in the wall of the intestine; the sole motive force in the propulsion of the ingested food appears to be exerted by the ciliary covering which clothes the internal surface of the alimentary tract from the mouth to the anus.

The words ento- and ectoblastic as applied to the adult, correspond to the embryonic epi- and hypoblast; mesenchyme to the mesoblast. I have adopted the terms from a paper on the mesoblastic layers of embryos by R. and O. Hertwig, in the *Jenaische Zeitschrift* (XV, 1st Hft., 1881), in which they discuss for the first time what they designate as the *Cœlom theory*, as applied to an explanation of the origin and typical forms of mesoblast as derived from the gastrula stage, typical of all metazoan development. The body of facts which is brought forward embraces the results of the work of the principal embryological authorities, and, although they had already been interpreted in a somewhat similar way by Huxley and McAlister, are for the first time connectedly stated so as to be of fixed value in embryological studies. They have given us a topography of the embryonic layers of the greatest value, which enables us to decipher with the greatest ease the relations and genesis of the parts of a form as comparatively undifferentiated as the adult oyster. In that they have considered *Chiton* as a member of their second subdivision of the *Metazoa*, the *Pseudocœlia*, characterized by the genesis of the mesoblast by proliferation from the epiblast and hypoblast, a massive, soft, and unsegmented, bilaterally symmetrical body, it is clear from what has preceded that the oyster is also typical, and a member of this group.