XVIII.—*On the Chylaqueous Fluid in the* Actinoida.

By P. H. Gosse, F.R.S.

To the Editors of the Annals of Natural History.

Sandhurst, Torquay, Feb. 12, 1858.

Gentlemen,

In the 'Sea-side Studies' of Mr. G. H. Lewes, the statement is made, as the result of careful experiments, that the Sea-Anemones are totally destitute of any organized fluid answering to blood. His declarations on this head are full and clear. "This animal is not only without 'blood,' in any proper sense of the term, but also without that simpler form of blood named 'chylaqueous fluid' by Dr. Williams and succeeding writers." "No such fluid circulates in the Actiniæ,—an assertion which can readily be tested. The water is easily forced out of the tentacles, or collected by cutting open the Actiniæ in a glass. Evaporate it, and you will find it to be sea-water holding sometimes organic particles in solution. Test it with concentrated nitric acid, and instead of becoming turbid, as it would if it contained albumen in solution, it remains unaltered, except that when organic particles are present, they become distinct. Examine the fluid with the microscope, and you will find animalculæ and various particles, but nothing like definite corpuscles, such as are visible in the true chylaqueous fluid. It is, in short, sea-water, and nothing more*."

Doubting his own correctness, Mr. Lewes had recourse to Mr. R. Q. Couch, who undertook to repeat the investigation. The latter gentleman, with a power of 300 linear, examined, on repeated occasions, specimens of *Actinia mesembryanthemum*; but could discover in their contained fluid "nothing organic; and [except in one instance] it gave no cloudiness by nitric acid." The exception is, that in one case the water from the tentacles, when treated with nitric acid, "had a slight opalescent deposit, or rather, a diffused milky cloud of very slight character." This occurrence did not prevent Mr. Couch from regarding "this fluid as merely sea-water, free from every admixture of secreted matter." And a similar occurrence of the slight milky cloud, once, and only once, in Mr. Lewes's observations, he notices, as "showing that it arose from an accidental, not a constant element†."

Mr. Lewes rightly presumes that his physiological readers will receive this statement "with surprise," and that it will even "startle" them. It so far surprised me, that I at once set about

* Sea-side Studies, p. 257.

† *Op. cit.* pp. 257, 258.

testing its correctness; and I now send you the following results of my experiments.

I should premise, that in each of the following examples the fluid was taken from the animal *out of water*; either, as in the case of *A. mesembryanthemum*, one that had stationed itself at the surface, so that its body was partially exposed and dry; or one that became so exposed by a slight tilting of the vessel; or one that was taken out of the water. In all cases, the surface was carefully wiped with a soft linen cloth, to remove the external sea-water. The fluid was then obtained by making with a lancet an incision through the integuments, and by taking up the flowing liquid by means of a pipette, which, in some cases, needed to be inserted into the wound, before capillary attraction would induce the *liquor vitalis* to flow up.

The drop thus obtained was then deposited in an aquatic stage-cell, and flattened by means of the thin-glass cover. It was then submitted to a power of 600 linear under one of Powell's microscopes, the measurements being made with one of Jackson's eye-piece micrometers. Afterwards its albuminous character was tested by the addition of a minute quantity of nitric acid. The pipette was scrupulously cleansed, between the experiments, by repeated injections of fresh water, and all the instruments used were similarly washed and wiped.

Actinia mesembryanthemum.—The fluid was rather thinly studded with organic corpuscles; nearly circular in form, smooth and well defined in outline, delicately granulose in texture, and pale yellow in colour. They varied in dimensions from ·0002 inch to ·0007 in diameter; but the great majority averaged about ·0003. A drop of the same fluid spread on a slip of glass was perfectly hyaline; but, on nitric acid being added to it, it became distinctly milky.

Anthea cereus.—Corpuscles moderately numerous; mostly circular, rarely oblong, and drop-shaped; of a clear pale yellow hue; granulose; dimensions from ·0001 to ·0003, average ·0002 inch. With nitric acid, milkiness barely perceptible.

Sagartia parasitica.—Similar corpuscles, but far fewer and smaller; dimensions varying from ·0001 to ·0003, the majority about ·00015. With nitric acid, the milkiness was very slight, but perceptible.

Sag. nivea.—Corpuscles abundant, clear pale yellow; not *apparently* granular; more highly refractive than the surrounding fluid*; irregular in shape and size, but for the most part ovate or elliptical, averaging about ·0008 inch in longer dia-

* This character is not intended to be distinctive of this species; I believe it marked the corpuscles in all cases; but it was in this example that I first tested it by *focusing*.

meter by ·0003 in shorter. Treated with nitric acid, the drop immediately and strongly coagulated.

Sag. bellis.—Corpuscles moderately few; remarkable in general for the perfect circularity of their figure; from ·0001 to ·0003 inch, but for the most part attaining the latter measurement. Under nitric acid, a milkiness very slight, but perceptible, was produced, much as in *S. parasitica.*

Bunodes clavata.—Corpuscles rather sparsely scattered; varying much in size, from ·0001 to ·0008 inch, but averaging ·00025; their form roundish; their appearance (as usual) pale yellow, granulose; and the larger ones contained oil-globules.

Bunodes crassicornis.—Corpuscles very few and remote; nearly round; clear pale yellow; not evidently granulose; averaging from ·00015 to ·00025 inch. With the addition of nitric acid, no milkiness was produced that I could with confidence pronounce as such.

This specimen of *B. crassicornis,* after having been wiped dry with a cloth, I allowed to lie in a saucer without water for half an hour, and then tapped it a second time. I wished to ascertain whether the fluid contained within the body at any given moment, would or would not become more organized, if allowed to remain without communication with the sea-water. The fluid was now, as I had anticipated, very rich in morphotic elements, being *densely crowded* with corpuscles having the same character and average dimensions as those I had found at first. There was, moreover, a very marked coagulation, under treatment with nitric acid.

Yet again; having taken this Anemone from the saucer, I found about a quarter of a teaspoonful of fluid where it had lain, which had drained from it during the forty minutes that had elapsed since I had taken it from the tank. I examined a drop of this fluid. Though not quite so full of morphotic matter as that last taken from the animal, it was still richly corpusculated; and, on the addition of nitric acid, coagulated *strongly.*

But were not these exceptional cases? Have I not selected for record a few samples in which I succeeded in finding organized elements, cushioning the many in which I failed? No: I have given the results of every case that I examined. The specimens were taken at random, and yielded the same undeviating result. There was not a single exception.

Having thus found corpuscular elements in the chylaqueous fluid of the above seven species, of four genera, I next set myself to examine the water of the different vessels in which the animals had lived. These tanks and vases were five in number. A drop of water, taken from each of these in succession,

and separately examined, proved absolutely free from the corpuscles that I had found in all the Anemones, with this doubtful exception: I found in one drop a single solitary corpuscle. But the presence of that one might safely be attributed to the fact, that I had previously returned one of the wounded animals to the vessel in question, and from this individual it had probably escaped.

Mr. Lewes suggests that possibly his predecessors in research had mistaken for blood-elements "the yellow spherical cells (?) which fill the tentacles of the adult Daisy, and make solid the tentacles of the *Anthea*." Of the function of these yellow spheres he confesses himself ignorant. The supposition is untenable. These spherules are pigment-cells, and they do not fill, far less make solid, the tentacles, but merely line their interior. These pigment-cells occurred in several of the experiments recorded above, and especially in the fluid obtained by incising the body of *Sagartia bellis*; but there is no possibility of confounding these with the morphotic corpuscles of the chylaqueous fluid: they differ notably in size, colour and structure. The corpuscles (in *Anthea*) average ·0002 inch in diameter; the pigment-cells are fully double this size: the corpuscles have a very faint yellow tinge, *seemingly* disks rather than spheres, with no definite walls, and composed of granulose substance; the pigment-cells are of a full but translucent golden-brown hue, very regularly globular in form, evidently spheres, and with a distinct wall.

It is not with any feeling of disrespect to either of the gentlemen named, that I forward these results for publication in the 'Annals.' The subject in question is one of considerable physiological importance; and as diametrically opposite conclusions have been arrived at by independent observers, and as it must be settled by the weight of testimony, I have thought it well to add my mite of evidence in favour of the affirmative side.

I am, Gentlemen,
Yours faithfully,
P. H. Gosse.

XIX.—*On the Formation of the Egg and Fertilization in the* Nematoidea. By Edouard Claparède*.

The dispute between Nelson, Bischoff and Meissner with regard to the formation and fertilization of the eggs in *Ascaris mystax*, has not yet attained any satisfactory solution. Not one of these three observers has retracted anything of his previous statements,

* Translated from Siebold and Kölliker's Zeitschrift für wissenschaftliche Zoologie, vol. ix. p. 106, by W. S. Dallas, F.L.S.