Notes on the Development of *Mytilus edulis* and *Alcyonium digitatum* in the Plymouth Laboratory.

By

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1. Mytilus edulis.

No very definite statement has yet been made as to the time when *Mytilus edulis* spawns at Plymouth. However, in 1911 records of spawning in the Laboratory tanks were made in January, February, and March, and in 1912 two specimens removed from the tanks spawned in early May.

Between May 10th and 21st, 1912, 100 mussels from Plymouth Pier were kept in a Laboratory tank, but as they did not spawn they were then opened, and many found to be either spent or only partly ripe. Examination of samples brought in between May and August seemed to indicate that the spawning season was finished, and occurred therefore in the early spring.

Various attempts were made at artificial fertilization from apparently ripe members of the selected hundred, but in one case only was fertilization successful—May 21st. A piece of ripe ovary and of ripe testis were shaken about in separate finger-bowls containing "outside" water, and thus ripe eggs and spermatozoa were freed in the respective bowls. At 12 noon a few drops of water containing spermatozoa were added to the finger-bowl containing ova, and at 4 p.m. that day many of the ova were developing—some showing Polar Bodies, others the early segmentation stages. Next morning the ciliate trochospheres were swimming at the top of the water in the finger-bowl, and these were removed with a pipette to two small "Breffits" * containing outside water, to which a few drops of a Nitzschia culture were added. Development gradually proceeded, the velum at this time being of very large relative size, and as Wilson states ("5th Annual Report Fishery Board for Scotland, 1886–87"), the shell muscles and alimentary canal are now elaborated, the valves of the shell being finely pitted and almost semicircular in shape.

However, while Wilson states that his larvae (now twelve days old)

* Wide-mouthed jars of green glass of about 2 litres capacity.

never progressed beyond this stage, the specimens reared in Plymouth continued to grow and develop, and are still doing so, although very much below normal size, judging by specimens of this year's mussels brought in from outside. The valves gradually assumed a shape rather like a minute edible cockle, and about July 22nd, a purple colour—the beginning of the prismatic shell substance—appeared at the edge of the valves, behind the velum, and extending to the posterior edge of the shell. The smallest individual in which the prismatic shell substance was visible measured ·21 mm. long × ·19 mm. high. The larvae still swam with the velum and the foot was growing rapidly in size. The eye spot was present and five gill filaments, and the valves measured ·31 mm. long × ·24 mm. high. From now onward the larvae grew at varying rates, some fixing by a byssus, while many others remained unattached and much smaller, creeping about the jar. The purple colour gradually extended over the valves, fading at its edges into brown. On August 6th the foot had become very long, thin, and active, the gill cilia were long and powerful, and the velum was decreasing slowly in size. Later the foot was frequently used as a creeping organ, and on August 15th I drew one specimen that could both swim with the velum and creep with the foot; it measured ·29 mm. high × ·32 mm. long, and had six gill filaments. A similar specimen measured ·32 mm. high × ·38 mm. long, so that the young mussel ceases to swim at a much later stage than the individual Wilson saw (see Wilson, loc. cit.).

From time to time more Nitzschia was added to the jars as food, and the outside water renewed, in which they lived.

Other specimens drawn on the same day had lost the large velum and the power of swimming, and were crawling with the long tongue-like foot about the glass jars. Measured specimens were:—

·35	mm. high	×	·413	mm. long,	with	5	gill filaments.
·385	„	×	·46	„	„	8	„
·41	„	×	·574	„	„	10	„

In the last individual the shell resembled a minute adult shell, being much thicker and of elongated oval shape, and dark blue in colour.

On August 27th most of the young mussels were crawling about the jar, many near the water surface, the largest measuring ·74 mm. high × 1·16 mm. long, with 15–16 gill filaments. The eye spot was still visible through the shell. During September they attached themselves to the glass at various levels—some at the water surface—by a delicate byssus, all but one being fixed by October 4th. When removed forcibly they soon refixed. About October 15th the jars were aerated

by a slow, fine air jet to keep the food in circulation, and this is still kept up, the mussels slowly increasing in size.

The largest individual in the jars at present measures 2·2 mm. long × 1·5 mm. high.

Note.—On August 7th, 1912, several swimming larvae, including one mussel that could both swim and crawl, were placed in a Breffit with a little of the water in which they were brought in. The jar was then filled with outside water, and the mussel, three Anomia sp. larvae, and several gastropod larvae developed and grew in this jar. No food has been added. The mussel is much larger than those wholly reared in the Laboratory, and measures 4 mm. long × 2·0 mm. high. The Anomia sp. measures 10·25 mm. across the widest diameter of the shell.

2. Alcyonium digitatum.

Male and female colonies of *Alcyonium digitatum* were placed in a tank on January 26th, 1912, and from January 27th to February 3rd, eggs in various stages of segmentation were pipetted out of the tank where they were floating, into Breffits containing Berkefeld or outside water. Hence the early critical stages of maturation and fertilization took place in the tank water. On January 28th many advanced morulæ passed into a curious irregular stage, which in turn became a round ciliate planula. This elongated gradually to an oval swimming planula, and as development proceeded the shape became pear-like, the larva swimming with the broad anterior pole forward, and simultaneously rotating on its axis. The characteristic reddish-brown colour of the egg gradually became pale cream as the larvae absorbed the yolk, and planarian-like contractile movements were observed when they were irritated by light, pipettes, etc.

Later they floated towards the base of the Breffits or near the surface film, with the long axis vertical and the anterior pole upwards, and on February 6th, some larvae had fixed on the glass at the surface film. Shrinkage now took place along the long axis, so that the oval larva became short and dome-shaped, and through the glass Breffits the eight mesenteries were visible. Some larvae settled on glass rods, glass cover-slips, and pieces of paraffin which were introduced into the Breffits at this time. By invagination of the ectoderm at the free pole of the larva, the mouth and stomodeum now arose,—fifth day of fixation, and as the yolk was absorbed it became paler and more transparent. Later eight simple tentacles appeared round the mouth, so that the larva now resembled a small anemone. By February 17th the tentacles were well developed and bore 2–3 lateral branches, and they waved gracefully about in the water if undisturbed, but retracted completely if shaken or disturbed. Forty days later the solitary polyp had grown very considerably, but no lateral buds had arisen. The

base of the polyp now was approximately 1 mm. in diameter. The only food added to the water was a little Nitzschia from time to time, but they were never seen taking it in.

They lived healthily until April 3rd,—two months approximately, but were then preserved, as flagellates had attacked them.

This work is being continued and amplified, and it is hoped that a complete account of the development of *A. digitatum* will soon be forthcoming.