## 4. The Viviparous Synapta of the West Indies.

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During the past few months, I have had the opportunity of studying the anatomy and development of a viviparous Synapta, found in Kingston harbor, Jamaica, very probably the species which Oersted described in 1850, under the name of *Synaptula vivipara*. At the present time Oersted's species is one of the Synaptidae about which little or nothing is known; it is so considered by Théel in his systematic review of the Holothurioidea in the »Challenger Report« (Vol. XIV, Part XXXIX, page 32). It is hoped that the following description will serve to define the species and give it its proper place in the group.

External Characters: Length from five to fifteen centimeters; diameter from three to five millimeters. Tentacles twelve, rarely thirteen, long and slender; sometimes one or two are longer or shorter than the others; digits from 25 to 37, the older the animal, the greater the number. Surface of the body very rough owing to the anchors in the skin. Color, reddish — or greenish — brown of various shades, usually rather dark and often with numerous white spots, due to aggregations of miliary granules. Body semi-transparent, the longitudinal muscles and the intestine showing plainly.

Internal Anatomy: Alimentary canal long and slender, with a single simple convolution and somewhat enlarged to form the cloaca. Haemal system simple but well-developed. Calcareous ring narrow, of 12—13 pieces, five of which are pierced for the nerves; each piece is simple without posterior prolongations of any kind. Cartilaginous ring present, directly beneath, and of the same width as the calcareous ring. Water-vascular ring a little below the cartilage, with from two to seven polian vesicles of various sizes, the largest being about six mm long. Madreporic canal single and small, lying close beside the dorsal mesentery. Genital gland usually with tree main branches, situated anteriorly and dorsally, beside the mesentery and opening just above the mouth, well within the ring of tentacles. Otocysts ten, arranged in pairs beside the nerves, as usual. Ciliated funnels, very numerous on the mesentery, short and rather wide, apparently not on long pedicels, as in *S. digitata*. All specimens examined, collected from the end of april until the middle of July, contained more or fewer young in various stages of development. Average number from fifty to seventy-five; maximum 176. Nearly always the young were of two ages, several days apart; very rarely three broods were found.

Calcareous deposits: Miliary granules present in great quantities, often crowded together to form spots in the skin visible to the

naked eye; these granules are very minute irregular rosettes, about 10 μ in diameter. Anchors, from 200—250 μ long, straight or slightly arched inward, with smooth arms; a few small blunt teeth on the vertex; arms not in the same plane as shaft but bent outward; posterior end broadened out to form a short notched or branched bow, with numerous fine pointed teeth. Plates from 130—140 μ long and about 110 μ broad; edges smooth; six anterior holes large, with about 14 coarse blunt teeth; seventh large hole, with about four blunt teeth on its anterior margin, somewhat pointed behind; medium sized hole on each side of this and three small ones back of it, all with smooth edges. External side of the plate with a bow, which starting from the outer edge of the medium sized smooth holes, bends outwards and forwards, bearing a few teeth on its anterior border. All these calcareous particles are very much like those figured by Théel for *Synapta picta* (Challenger Report, Vol. XIV, Part XXXIX, Plate I Fig. 9). But there are in addition, small straight or curved rods about 200 μ long which may be perfectly smooth, somewhat knobbed or enlarged and rough at the ends; more rarely slightly forked or branched. These rods occur only in the tentacles, chiefly at the tip, and they seem to be more abundant in young than in old Synapta. They lie parallel to the long axis of the tentacle or if in a digit, parallel to its long axis.

Development: Eggs unusually large, about 210 μ in diameter, light yellow in color. They are set free in the body cavity of the adult, but whether self-fertilization takes place or not, I have been unable to determine. Artificial fertilization never succeeded no matter whether the ova and spermatozoa came from the same or different animals. Ripe sperm and apparently ripe ova occur at the same time in the same individual. Segmentation is total and equal. No polar bodies were found altho looked for carefully. Segmenting eggs are surrounded by a delicate vitelline membrane, probably formed as a result of fertilization, as it is wanting in unfertilized eggs. At the 16-cell stage, the embryo appears as a ring or band, two cells wide and eight cells in circumference, surrounding a cavity which is cylindrical instead of spherical and open at both ends. The 32-cell embryo is arranged in four series of eight cells each; the upper- and lowermost of these series have a less diameter than the two middle series and accordingly the embryo begins to assume the spherical form, altho the sphere is still open at the poles. Subsequent divisions close these openings and form the complete blastula. Invagination takes place and the gastrula develops as shown by Selenka for *S. digitata*. The gastrula is well covered with cilia and soon escapes from the egg-membrane. It is very active and swims about freely in the body cavity of the mother. Devel-

opment takes place directly without any metamorphosis. The gastrulas soon become less active and after a short time lose their covering of cilia. The subsequent changes until the assumption of the pentacula form involve so many debatable points that they cannot be entered into here but a complete account of them will be published hereafter. The young remain in the body-cavity of the adult for an indefinite period; many are born when not more than five or six mm long and with the tentacles still few and simple; but it is no uncommon occurrence to find young 20 mm long, with branching tentacles and pigmented skin, still inside the adult. The young escape from the body cavity into the cloaca and thence through the anus to the exterior.

Habits: The animals live more or less socially in clusters of seaweed on the roots of mangroves. They creep about by means of the long, slender tentacles, assisted by the numerous anchors in the skin. Their food consists of minute algae, crustaceans and worms. They are very delicate, sensitive to changed conditions and do not thrive in aquaria.

Distribution: I have found this *Synapta*, only at Port Royal in Kingston harbor. I have looked for it elsewhere in the harbor and in suitable places in other ports of Jamaica but without success. It appears to be very local even at Port Royal and the area, where it may be found at all commonly, is very limited.

From all these facts, it is clear that, altho differing in its manner of life, its being viviparous and its lack of a metamorphosis, from other members of the genus, this species is a true *Synapta*. As Ludwig has already suggested (Arch. de Biol. Vol. II, 1881) there ought to be some better ground for generic distinction than the stage at which the young are born, and lacking this, *Synaptula* has no standing as a genus and becomes a synonym of *Synapta*. The species *vivipara* belongs to the same section of the genus as *S. inhaerens*, as shown by the anchors and plates and the number of tentacles. It is very interesting to note that in every particular given in his description, the species from Bermuda described by Théel (Challenger Report, Vol. XIV, Part XXXIX, page 10) as *S. picta* agrees with *S. vivipara*. As there was only one small specimen of *S. picta* in the collection and nothing is known of its habits, the identity of the two species is uncertain but at any rate, their similarity is very remarkable and further information regarding the Bermuda species would be of great interest.

A more general account of *S. vivipara* with figures of the anchors and plates and the early stages of the embryo may be found in the »Journal of the Jamaica Institute« for July, 1896.

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