ART. XI.—*Brief Contributions to Zoölogy from the Museum of Yale College.* No. X.—*Descriptions of some imperfectly known and new Ascidians from New England;* by A. E. VERRILL.

Molgula Manhattensis Verrill. Figure 1.

Molgula Manhattensis Dekay, Report on the Natural History of New York, Mollusca, p. 259, 1843; Binney, in Gould's Invertebrata of Massachusetts, 2nd ed., p. 25, 1870, (copied from Dekay).

BODY somewhat oval, subglobular, or slightly cordate, usually somewhat compressed laterally; when crowded often slightly adhering together laterally and more or less deformed; usually adhering to eel-grass (*Zostera*) and various sea-weeds, or to the under side of stones, by the left side, or obliquely by the basal portion. The surface including the tubes is generally thickly covered with fragments of eel-grass, broken shells, particles of sand, and various kinds of debris so as to entirely conceal the surface and disguise the form; sometimes, however, in sandy regions the surface is nearly destitute of such covering. The integument is firm and thick, and when clean it is translucent and roughened throughout with minute, gran-

ule-like papillæ, which are larger and more crowded on the upper part and around the base of the tubes, where they often form small, rough, unequal verrucæ. The tubes originate on the upper side, a little apart, the distance between usually about equal to the diameter of the anal tube;* they are both rather long and diverge by curving outward from the base. The anal tube is smaller and somewhat longer than the branchial, usually about equal in length to half the diameter of the body, and tapers to the end, which is rounded and has a small square aperture, its sides, near the end and often below, are usually roughened by irregular, uneven papillæ. The branchial tube is shorter and stouter, widest at base, truncate at the end, with six, small, obtuse, rounded papillæ surrounding the orifice; outside of these there are six, short, triangular lobes; below these there is often an irregular circle of about six to twelve rougher papillæ, alternately larger and smaller, and sometimes other more irregular ones below, between the sulcations; these are, however, sometimes wanting, as in the specimen figured. In contraction the tubes form low, rough verrucæ, the anal often four-lobed, both covered with rough, irregular papillæ.

The inner tunic, which is closely adherent to the outer, is smooth, pellucid, light greenish, the dark intestine and a reddish organ below it showing through.

* The figure represents them as arising nearer together than is usually the case.

In life the body and tubes are pale yellowish green or olive; the branchial orifice is sometimes surrounded within by a ring of dull reddish brown, the six lobes have each a spot of dark brown, with smaller ones between. The anal orifice is greenish yellow.

Diameter of the largest specimens seen, about 1 inch.

New York Harbor,—Dekay; Fire I., Long Island, abundant on eel-grass,—S. I. Smith; New Haven Harbor, on eel-grass, abundant,—A. E. Verrill; near New Haven Light on sea-weed, and at Savin Rock, under stones at low-water mark,—A. E. Verrill.

Molgula pannosa Verrill, sp. nov. Figure 2.

Body subglobular, or a little elongated, somewhat compressed laterally, entirely covered, except the ends of the tubes, with a firm and thick covering, composed of fragments of shells, echini, zoöphytes, worm-tubes, foraminifera, grains of sand, pieces of sea-weed, and other debris. The surface of the integument, when the foreign matter is removed, is densely covered with small granule-like papillæ, which give rise to very abundant, long, fine fibrous processes, by which the foreign matters are entangled; the basal portion of the tubes is covered with similar processes, though less numerous, which decrease toward the end, leaving the terminal portion nearly smooth. The tubes, which arise close together, are short, conical, a little divergent. The anal tube is a little longer than the branchial, swollen at base, tapering, and rounded at the end, which has a very small square aperture. The branchial tube is about the same in size, but a little shorter, subcylindrical, scarcely tapering, with six, small, prominent, acute lobes or papillæ; alternating with these are six much smaller ones. In contraction the tubes can be wholly withdrawn, and then the body looks like a more or less irregular ball of dirt.

In life the color of the clean integument is a dull, dark, grayish green; the tubes lighter, or dull olive-green.

A large specimen, when expanded, was 1 inch in length; .75 broad; .50 thick.

Eastport, Me., 10 to 50 fathoms, muddy and shelly bottoms,—Expeditions of 1868 and 1870; off Head Harbor, Campo Bello I., 80 fathoms, muddy,—Expedition of 1868.*

* The expeditions of 1859 and 1863 were by the author; that of 1864 by the author and S. I. Smith; that of 1868 by A. E. Verrill, S. I. Smith, H. E. Webster and Geo. A. Jackson; that of 1870 by A. E. Verrill, Oscar Harger and C. H. Dwinelle.

Molgula retortiformis Verrill, sp. nov. Figure 3.

Body subglobular or more or less oval, generally higher than broad and a little compressed laterally, destitute of a distinct disk, though generally adhering.

The integument is thick and firm, but translucent, usually covered, together with the tubes, by various zoöphytes, ascidians, fragments of shells, etc., which form a coarse, rough, and rather loosely adherent coating, but this is usually incomplete or thin and the surface more or less exposed. When cleaned the surface is roughened by small, scattered, granule-like papillæ, and irregular

rough processes, while in large specimens it is more or less rudely wrinkled. The large tubes arise from the upper part, a short distance apart, and are widely divergent and very unequal. The anal tube is much the longest, usually equalling in length the diameter of the body, very large and swollen at the base, curving outward and tapering to the end, which is blunt, with a small square aperture, its surface is often roughened with irregular processes, and in partial contraction is often sulcated. The branchial tube is usually about one-fourth as long, much smaller at base, curved outward, the aperture surrounded by six, short, conical, acute papillæ or tentacular lobes, its surface below often rough with irregular verrucæ. In contraction the tubes form large, low and rough verrucæ, or may be wholly retracted and invaginated, together with a portion of the integument of the body around their bases.

When living the color is uniform light olive, or grayish green.

The larger specimens are often 1.50 inches in diameter; with the anal tube nearly 2 inches long; the branchial about .50. In the collection there are specimens of all sizes from this down to less than .25 of an inch in diameter.

The young have essentially the same characters as the adults, but are smoother.

Eastport Harbor, South Bay, etc., from extreme low-water of spring tides to 50 fathoms, on rocky and shelly bottoms, adhering loosely by the sides, to other ascidians, zoöphytes, shells, etc., not abundant, though often met with,—Expeditions of 1864, '68, and '70; off Head Harbor, 80 to 120 fathoms,—Exp. 1870.

Molgula littoralis Verrill, sp. nov. Figure 4, a.

Body transversely oblong-oval, somewhat flattened laterally, and attached obliquely by a part of one side (usually the right)

to the under side of stones; when young subglobular. Integument firm and tough, but translucent, the tubes similar to the body; the surface smoothish in young specimens, in older ones slightly wrinkled, not fibrous, but somewhat roughened with sparse granule-like papillæ, to which a thin, imperfect coating of foreign substances is sometimes attached; in contraction the surface is reticulated with wrinkles, with more elevated interstices. Tubes short and stout, arising from the upper side, and separated by a distance about equal to or exceeding their diameters, quite divergent, the anal tube most so, not wholly retractile. The anal tube is about twice as long as the branchial and usually swollen in the middle, rounded at the end, with a simple square orifice, which in full expansion often becomes roundish. The branchial tube has about the same diameter, and is short, cylindrical, with six short conical papillæ around the orifice. In contraction the tubes form low verrucæ.

When living the color of the body is translucent, dull greenish or olive, between the tubes usually more or less ferruginous brown, or russet; on the sides the viscera show through as dull orange-colored and darker blotches.

One of the larger specimens was, while living, .45 of an inch long; height .35; length of branchial tube .10; diameter .10; distance between bases of tubes .08.

Eastport, Me., under stones near low-water mark, not uncommon,—Expeditions of 1868 and 1870.

In Binney's edition of Gould's Invertebrata of Massachusetts, there are three figures, reproduced from Mr. Burkhardt's drawings, which Mr. Binney refers somewhat doubtfully to *Glandula mollis* Stimpson, neither of which can represent that species. Of these, Fig. 317 (Pl. xxii) may, perhaps, represent the present species, but the apertures show no details.

Molgula papillosa Verrill, sp. nov. Figure 4, b.

Body free, nearly globular, or transversely suboval, usually slightly compressed laterally. Integument rather thin, translucent, the surface, both of the tubes and body, entirely covered by particles of sand, broken shells, foraminifera, etc., which adhere firmly. When cleaned the whole surface is thickly covered with prominent granule-like papillæ and numerous slender fibrous processes; the granules are most conspicuous on the tubes, where they usually have a rusty color. The tubes are long, subequal, and their bases are separated by a space usually greater than their diameters; they are quite divergent, both of them curving outward, the anal tube most abruptly. The branchial tube is cylindrical, somewhat longer than the

anal, equal to or exceeding the diameter of the body, the orifice surrounded by six, rather long and slender, conical, divergent papillæ. The anal tube often bends suddenly outward, tapers slightly, and has a small square aperture, surrounded by a circle of dull reddish brown. In contraction the tubes are not retracted, but are usually shortened to about one-half their length. In life the body, when cleaned, is pale grayish, with an almost transparent integument, through which the convolutions of the dark intestine are conspicuous.

The largest specimens are about 40 of an inch in diameter.

Eastport, at low-water mark under stones, and off the northern side of Treat's Island, in 10 to 20 fathoms, shelly bottom,—Expedition of 1870.

Molgula pilularis Verrill, sp. nov. Figure 4, c.

Body unattached, globular, covered with a thin layer of mud, and when the tubes are retracted, looking like a small soft ball. Integument of the body, when cleaned, very thin, soft, nearly transparent, thickly covered with minute granules, and minutely fibrous, usually concealed by the adhering particles of mud and fine sand, but this can be easily removed. The tubes are naked, smooth, nearly transparent, subconical, slender, nearly as long as the diameter of the body, originating close together, and but slightly divergent, both of them nearly straight; they can be wholly retracted and their bases are surrounded and connected by a narrow, naked, oval or oblong band, which is usually conspicuous when the tubes are withdrawn; in partial contraction, the tubes are conical, subpellucid, reticulated with white lines. The branchial tube is a little shorter than the anal, the aperture surrounded by six, acute, conical papillæ, and twelve, small, dark brownish spots. Anal tube a little smaller, slightly longer, a little tapering, with a small square aperture, surrounded by four small lobes and four small, reddish brown eye-spots.

In life the body, when cleaned, is transparent grayish, the dark intestine showing through very distinctly; tubes greenish at base.

Diameter usually about 20 of an inch, seldom more than 25 or 30.

Eastport Harbor, in 10 to 20 fathoms, muddy, common,—Expeditions of 1864, '68, '70; South Bay, Lubec, in 6 fathoms, soft mud, very abundant,—Exp. of 1868; Grand Menan, off Swallow's Tail, 15 to 20 fathoms, soft mud,—Exp. of 1870.

Cynthia glutinans Möller (Kroyer's Naturhistorisk Tidsskrift, iv, p. 94, 1842) seems to resemble this species in form and appearance, but if it belongs to *Cynthia*, or to *Glandula* where Stimpson refers it, both apertures must be square. *G. mollis* Stimp. must be a closely allied species, if not identical.

(To be continued.)