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On some Salpas occurring in the Vicinity of Seto, with Remarks on the Enantiomorphism found in some Aggregated Forms

By

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With 8 Figures

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In this paper I shall report on the species belonging to the subgenera *Cyclosalpa* and *Ritteriella*. Of the latter subgenus, the imperfectly known *R. picteti* (=*R. retracta*) will be described in some detail, while respecting the former subgenus, special attention will be paid to the curious *C. virgula*. In addition, I shall discuss the most interesting phenomenon of the so-called enantiomorphism noticed in the aggregated forms of certain species of Salpas by taking the case of *C. virgula* as an example. This phenomenon has been known for some time among the students of the group, but singularly it remains unknown outside of a very limited circle of specialists in this field. For instance, it is entirely left out of account in LUDWIG's recent book "Rechts-Links-Problem" (1932). Even among the specialists, this phenomenon has been dealt with only in passing, and never has received the attention it deserves. Under such circumstances, it may not be amiss to set down some special remarks on this subject here.

Subgenus **Ritteriella** (METCALF)

1. **Ritteriella picteti** (APSTEIN)

(Fig 1)

Salpa (*Cyclosalpa*) *picteti*, APSTEIN, 1904, 1906 a, 1906 b; IHLE 1910, 1912.

Salpa (*Cyclosalpa*) *retracta*, RITTER, 1906; IHLE, 1910, 1912; OKA, 1913.

Salpa (*Cyclosalpa*) *amboinensis*, APSTEIN, 1906 a, b.

Salpa (*Ritteria*) *picteti*, METCALF, 1918.

Salpa (*Ritteria*) *retracta*, METCALF, 1918.

Of this problematical Salpa, there is one specimen of the solitary form of 42 mm., length taken on Feb. 16, 1931, which has certain features forming a connecting link between the characteristics of *R. picteti* and *R. retracta*. In this specimen the part around the mouth is somewhat mutilated, otherwise it is perfect and no difficulty was encountered in examining the following points.

The body is elongated and roughly cylindrical in the dorsal view, except for being somewhat broader in the posterior half ; in the lateral view, the ventral region which contains the gut, is somewhat bulged out. The test is thin, transparent and colorless.

Both the oral and atrial openings are terminal in position. The precise state of the oral musculature is hard to make out ; but it seems to conform with RITTER's description. On the dorsal side there is a broad perfect sphincter (the second sphincter), and also a narrower imperfect sphincter (the first sphincter) near the lateral angle of the oral opening. A horizontal muscle stretches between the second sphincter and the intermediate muscle to be mentioned below ; the anterior end of the horizontal muscle almost touches the second sphincter. The ventral lip is inturned. There are three broad ventral sphincters, of which the second (l_2) and third (l_3) are the direct continuation of the second dorsal sphincter. The first and third sphincters are perfect muscles, while the second seems to be imperfect. In fig. 1 which shows the ventral aspect of the specimen, the first sphincter is not shown, since it is located in the inturned part of the ventral lip. The oral retractor (*o. r*) traverses these sphincters as shown in RITTER's figure. The atrial siphon as well as the musculature,

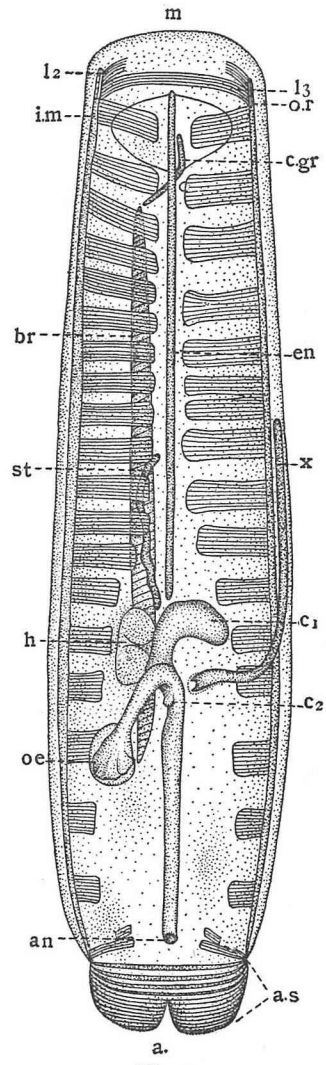

Fig. 1.

Ritteriella picteti (APSTEIN). Solitary form. View from ventral side × 3.

is exactly like that in his description and figure. The siphon has four notches, one on each median and lateral line. The atrial sphincters (*a. s*) are 13 altogether, of which the anterior four or five are broader and wider apart than the rest. The first atrial sphincter is interrupted on the ventral side. In front of this muscle, is found a short transverse muscle whose relation to the other muscles is not clear in this specimen.

The intermediate muscle (*i. m*) is like the body muscles, except that it is interrupted by a wide median gap on the dorsal side. The body muscles show some degree of asymmetry, and division and union of individual bands. There are in all 14 bands on the left side, and 18 on the right; on the ventral side the fifth band on the left side is bifurcated. These bands meet one another on the dorsal side, and produce a zigzag line very characteristic of this species. On the ventral side, all of these muscles are interrupted, contrary to RITTER's description: "second to tenth inclusive not interrupted at any point" (p. 2). It is true that the ventral ends of the muscles in the anterior half of the body approach the mid-ventral line rather closely; but all of them are interrupted there, and never meet the ends of the corresponding muscles on the other side. The ventral ends of the muscles localized in the posterior half of the body, lie more apart from those of the other side.

The gill (*br*) extends from the level of the first body muscle to that of the body muscle third from behind. The ciliated groove (*c. gr*) is elongated, and curved at the middle point where the peripharyngeal band is united. The ganglion is situated in front of the first body muscle just midway between the muscle and the curvature of the ciliated groove. The endostyle (*en*) is more than half as long as the body.

The oesophageal opening (*oe*) is a large funnel-shaped aperture situated at the level of the body muscle third from behind; the oesophagus proceeds in the antero-mesially ventral direction, to the level of the preceding body muscle. The gut then turns abruptly backward, and runs straight in the ventral protuberance mentioned above, and opens near the atrial aperture. A large caecum of a shape like the head of a golf-club (C_1), is attached to the gut at the point of curvature of the latter, with its convex side facing ventrad. A much smaller caecum of a nipplelike appearance (C_2), the presence of which has never been noticed by the previous authors, is found on the other side of the gut. The heart (*h*) is located close to the large caecum on its right side. The stolon (*st*) is still very young and short, and extends over only a distance of 4 or 5 muscle-bands. The problematical body (*x*) noticed by RITTER and others, is a strand which starts at a point very close to the curvature of the gut,

and goes in the dorsal direction, and then turns forward, to stretch along the left side of the body to the level of the fifth body muscle. Concerning the nature of this body, I shall speak later.

Remarks—S. picteti was first described by APSTEIN in 1904 from a specimen obtained in the Bay of Amboina. A second specimen was recorded in 1906 by the same author from among the material collected by the 'Valdivia.' Among the same material also, was found another specimen of a similar Salpa; this however, was considered by APSTEIN to belong to a different species, *S. amboinensis*. IHLE, some years later (1910), reexamined the same specimen, and ascertained that it should be referred to RITTER's *S. retracta*. Now, this *S. retracta* was originally described by RITTER in 1906 from a specimen collected in the Suruga Bay on the east coast of Japan, apparently without knowing either of *S. amboinensis* or of *S. picteti* recorded only a few years previously. RITTER seems to have been convinced of the novelty of his specimen, judging from his statement that " This, however, is in a good state of preservation, and so strikingly different is it in several particulars from any species of the group hitherto described that there can be no risk in basing an outline description on the one individual " (p. 1). Especially, he puts much emphasis on the feature that the body muscles in the anterior region of the body form complete rings. In fact, he goes so far as to propound, on the basis of this feature : " The species detracts considerably from the value of the distinction between the Doliolidae, and the Salpidae, implied by the terms cyclomyaria for the former, and hemimyaria for the latter " (p. 4). This feature also has been reported to be shared by APSTEIN's specimen recorded as *S. amboinensis*, and METCALF (1918) points out this to be characteristic of *S. retracta*. IHLE, however (1910), has found that in the specimens of *S. retracta* which he examined, all of the body muscles are interrupted ventrally. In the specimen before me also, all of the muscles are interrupted near the mid-ventral line. With the desire of making sure of this point in the type-specimen of *R. retracta*, I looked for the specimen in the Zoological Institute of the Tokyo Imperial University. Unfortunately, however, I was unable to find it; apparently it was destroyed by the great earthquake of 1923 together with numerous other precious specimens. At any rate, it is very doubtful whether one can put so much importance on that feature of the musculature in *R. retracta*, even if RITTER's observation on this point is warranted.

Next, as to the other points which have been considered as differentiating *R. picteti* and *R. retracta*, the number of body muscles appears to be the only one which deserves any consideration. *R. retracta* is

regarded to be furnished with 10–15 body muscles, while *R. picteti* has 21–26. Accordingly, IHLE (1910), who has been impressed by the similarity of these two alleged species, has expressed the view that, if an individual with 16–20 body muscles be found, the two alleged species should probably be merged into one. Now, the present specimen has a feature that fulfills this requirement: there are 14 body muscles on the left side and 18 on the right; further it shows a clear sign that these muscles increase by longitudinal splitting. Thus, it seems to be safe to unite those two alleged species, and call it *R. picteti* according to the law of priority.

The problematical body mentioned above, is a narrow tube imbedded in the test. The internal cavity is filled with blood corpuscles and their developmental stages. Apparently it is a portion of the haemocoelic system, and there is a very thin epithelium around it. IHLE (1910, 1912) has assumed that the body is a kind of blood-forming organ, in which the blood cells increase. This seems to be a plausible view, if not quite right.

Subgenus **Cyclosalpa** (BLAINVILLE)

2. **Cyclosalpa pinnata polae** (SIGL)

(Fig. 2)

Salpa (*Cyclosalpa*) *polae*, SIGL, 1912; IHLE, 1912.
Salpa (*Cyclosalpa*) *pinnata polae*, METCALF, 1918; SEWELL, 1926.

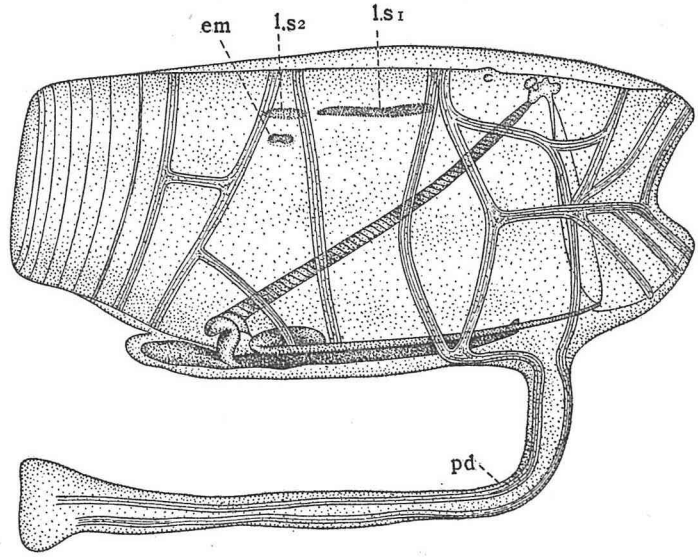

Fig. 2.

Cyclosalpa pinnata polae (SIGL). Aggregated form. View from right side. × 1.5.

The single specimen of the aggregated form of 55 mm. length conforms well with the descriptions and figures given by the previous authors. The only difference to be noticed is in the luminous stripes, which exist, not only in the area between the second and third body muscles (*l.* s_1), but also in that between the third and fourth body muscles (*l.* s_2) on either side. The peduncle (*pd*) is so long as to extend beyond the atrial aperture. IHLE also (1910) records a specimen of *C. pinnata* with two pairs of luminous stripes.

3. Cyclosalpa affinis (APSTEIN)

(Fig. 3)

Salpa (*Cyclosalpa*) *affinis*, APSTEIN, 1894; APSTEIN, 1906, a, b; RITTER and JOHNSON, 1910; IHLE, 1912; OKA, 1913; METCALF, 1918, SEWELL, 1926.

Salpa chamissonis, BROOKS, 1893.

Of this common species there is a well-preserved specimen of the solitary form (length 48 mm.) collected on Feb. 23, 1923. The species can readily be distinguished from the allied species by the complete absence of the luminous stripes either in the solitary or in the aggregated form. The intestinal caecum has been described as single. In reality, however, it is a double structure, composed of two lateral sacs much as in *C. pinnata*, but they are united throughout the length, and appear as single under casual observation. The double nature of the structure can be perceived even in the outside view of the distal end of the structure, and it is more apparent in the cross-section.

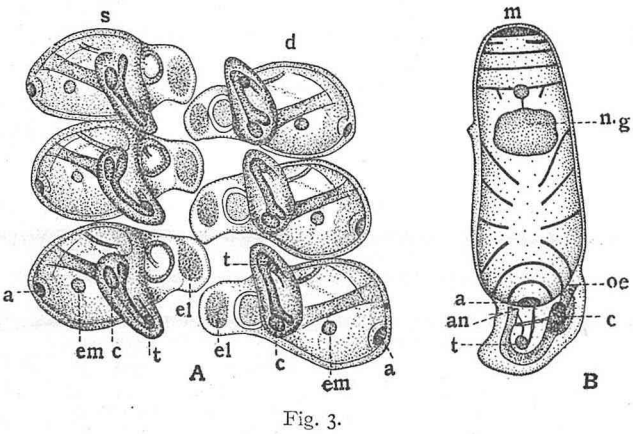

Fig. 3.

Cyclosalpa affinis (APSTEIN). Zoöids on stolon. A. View from dorsal side of mother. × 35. B. Dorsal view of a zoöid. × 45.

4. Cyclosalpa virgula (VOGT)

(Figs. 4-8)

Salpa (*Cyclosalpa*) *virgula*, APSTEIN, 1894, 1906, a, b, STREIFF, 1908; IHLE, 1912; METCALF, 1918; SEWELL, 1926.

Of this interesting species, a specimen of the solitary form and more than 30 specimens of the aggregated form were examined. Most of these were preserved in a good condition.

Solitary Form

(Figs. 4, 5*A*)

A large specimen of 230 mm., length collected on March 10, 1930. The test is thin and soft. The body is cylindrical and elongated; both the oral (*m*) and atrial (*a*) apertures are terminal and subequal in size. The dorsal lip of the oral aperture is provided with four sphincters, of which the anterior three (*u 1-3*) are very thin, while the fourth (*u 4*) is much broader and curved strongly backward, and is attached by its posterior margin to the anterior margin of the intermediate muscle. The first and second sphincters (*l 1-2*) of the ventral lip are united for the greater part of their length, being divided only at the anterior extremity; the posterior end is in contact with the first body muscle. The third sphincter (*l3*) is attached by its side to the side of the first + second sphincter, but separated from the latter on both the anterior and posterior ends. Of the atrial sphincters (*a. s*), the first is very broad on the dorsal side, but narrows abruptly near the ventral end, where it is in contact with the seventh body muscle. Besides, there are about 20 delicate sphincters in all, of which four are united ventrally, and form the atrial retractor (*a. r*).

The intermediate muscle (*i. m*)

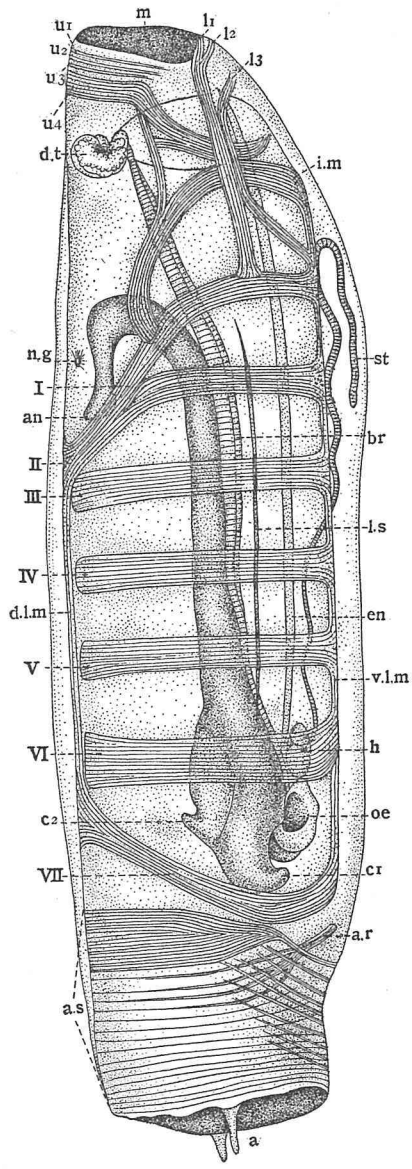

Fig. 4

Cyclosalpa virgula (VOGT). Solitary form. View from right side. × 2/3.

is curved strongly forward, with its dorsal end placed on the anterior margin of the first body muscle, and the ventral end bending backward to become the paired ventral muscle mentioned below. A horizontal branch of this muscle stretches between this muscle and the fourth dorsal oral sphincter.

Of the body muscles, the first (*I*) and second (*II*) have a common origin at the dorsal extremity, where they are directly continuous with the mid-dorsal longitudinal muscle (*d. l. m*). These two muscles are somewhat narrower than the other body muscles. The third to fifth body muscles (*III-V*) have a nearly uniform breadth and distance, and are perpendicular to the longitudinal axis of the body throughout their length. The sixth (*VI*), which is also almost strictly transverse, is distinctly broader than the preceding. The seventh (*VII*) is oblique and bends backward ; its dorsal and ventral ends are directly continuous with the dorsal and ventral longitudinal muscles respectively. The dorsal longitudinal muscle (*d. l. m*) is single, and stretches over the median line between the combined dorsal end of the first and second body muscles and the seventh body muscle just mentioned. The ventral longitudinal muscle (*v. l. m*), on the other hand, is double, the fibers of the two sides forming two parallel bands ; it is continuous with the intermediate muscle anteriorly and with the sixth and seventh body muscles posteriorly.

The gut is much elongated, and extends between the level of the

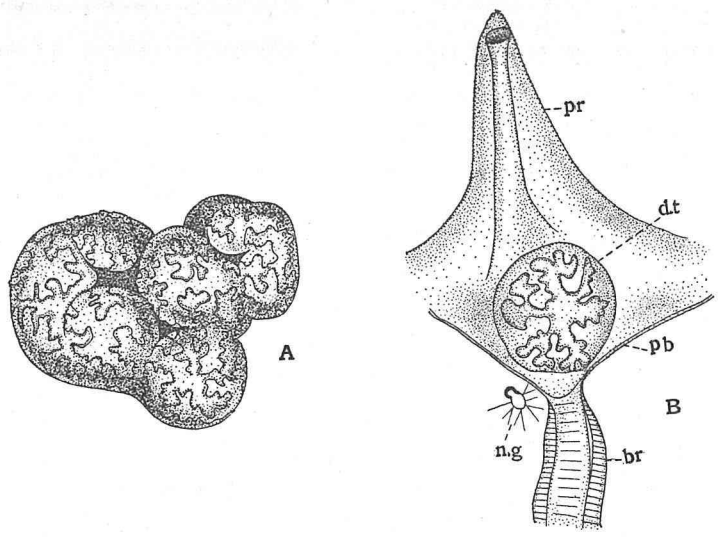

Fig. 5.

Cyclosalpa virgula (VOGT). A. Dorsal tubercle of a solitary form. × 3. B. Organs around the dorsal tubercle and nerve ganglion of a sinistral individual of the aggregated form. × 3.

seventh body muscle and that of the first. The funnel-shaped oesophagus (*oe*) opens between the sixth and seventh body muscles on the right side. Two caecal appendages are attached to the gut in its broadest part; one (*c. 1*) at the topographically posterior end and the other on the dorsal side (*c. 2*). The intestine narrows slightly forward, and is curved backward in a hook-like shape, and opens near the dorsal end of the first body muscle. The gill (*br*) is elongated and firmly attached to the ventral side of the gut. The neural ganglion (*n. g*) and the eye are situated at a level between the first and second body muscles. The ciliated groove describes an extremely intricate meandering course as shown in fig. 5A. The stolon (*st*) stretches forward slightly beyond the first body muscle, then it turns to the left. The luminous stripes (*l*) extend between the first and sixth body muscles.

Aggregated Form

(Figs. 5 B, 6, 7)

Altogether more than thirty examples of the length 20–55 mm. (without including the length of the process) were collected on Dec. 8, 1930 and Feb. 16, 1931 at Seto. The asymmetry in the musculature of this form is well known, as is also the existence of the dextral and sinistral types as regards this feature. There are 12 dextral and 17 sinistral individuals in this collection, besides 4 mutilated specimens in which the asymmetry is hard to determine.

The dextral individual (*Figs. 6A, 7A*). The body is ovoid in shape and very soft in texture; it has a tail-like process nearly half as long as the body at the posterior end, and a cushion like attachment-process (*a. p*) on the ventral side, but shifted to the left. The oral aperture (*m*) is terminal and large, while the atrial aperture (*a*) is dorsal and smaller. The gape of the mouth is oblique, the right corner of the mouth being situated higher than the left. The musculature is illustrated in the textfigures, and detailed description of it may be found in the works of previous authors, notably APSTEIN (1894) and METCALF (1918), so that any further comment seems scarcely needed.

The gut is localized in the hindmost portion of the body. The large caecum (*c1*) is directed forward and partly overlaps the heart (*h*); this is really the morphological left caecum as METCALF points out. The right caecum (*c2*) is much smaller and forms only an insignificant protrusion. The intestine runs dorsad; then it turns forward at the base of the tail-like process and proceeds horizontally and ternimates in the anus (*an*). The testis (*t*) is spherical and situated in the basal part of the tail-like

process ; the vas deferens (*v. d*) starts on the right side of the testis, and runs along the right side of the horizontal portion of the intestine, and opens very close to the anus. The tail-like process has a whitish core, which is probably homologous with the ' blood-forming organ ' of *Ritteriella picteti* mentioned above. The dorsal tubercle is large and the ciliated groove appears as shown in fig. 5 B. Just in front of this, and slightly on the left side, is a hollow horn-like process (*pr*) which has never been noticed by previous authors. Probably it does not develop before the individual grows to a certain extent.

The body is sprinkled with minute brown dots especially in the regions around the atrial aperture and in some parts on the lateral sides of the body.

The sinistral individual. As shown in figs. 6 B and 7B, the musculature shows the exact mirror-image of the dextral type. Moreover, the attachment process is shifted to the right side, and the horn-like process in front of the dorsal tubercle is localized on the right side of the latter. A greater difference is to be found in the posterior region which contains the gut. The long tail-like process at the postero-dorsal point of the body existing in the dextral individual is represented here by a very short conical process at the postero-ventral corner. The winding of the gut and the position of the testis is also different. The oesophagus (*oe*) is placed much higher than in the dextral individual. The intestine proceeds first ventrad instead of dorsad, and coming to the postero-ventral corner of the body, turns back to go in the dorsal direction

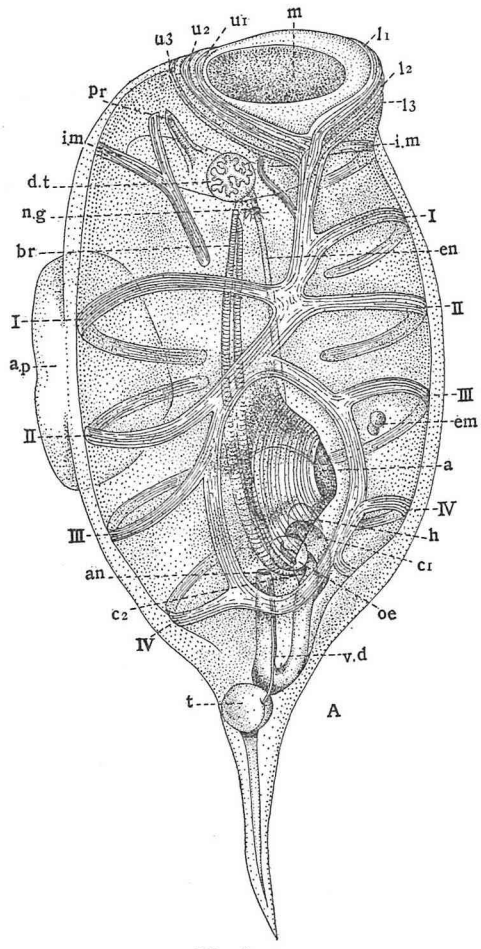

Fig. 6. A.
Cyclosalpa virgula (VOGT). Aggregated form. Dextral individual. View from dorsal side. × 2.

and opens on the left side of the oesophagus very close to it. The caeca are on their original side, the larger one (*c1*) being on the left side and the smaller one (*c2*) on the right side of the gut; the larger caecum is directed obliquely upward. The testis (*t*) is situated at the postero-ventral corner of the body in a protuberance at the base of the small conical process mentioned above. The proximal part of the vas deferens (*v. d*) is on the left side of the intestine, but the distal part passes along the right side of it.

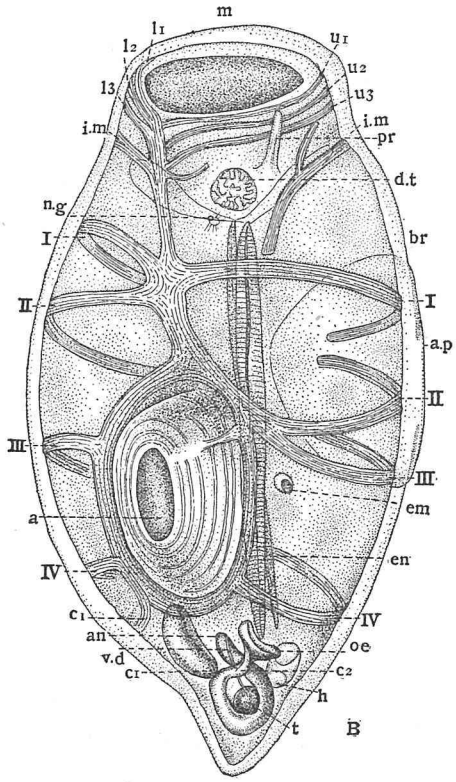

Fig. 6 B.

Cyclosalpa virgula (VOGT). Aggregated form. Sinistral individual. View from dorsal side. × 2.

Remarks on the Enantiomorphism found in the Aggregated Forms of some Salpas

It is known among the specialists of this group, that in certain species there occurs a marked asymmetry of the body musculature. This is found only in the aggregated form, and especially in such species as *Cyclosalpa virgula, C. bakeri, Brooksia rostrata, Ritteriella amboinensis, Apsteinia punctata, A. asymmetrica* and *A. magalhanica.* It is also known that in these species, there are two kinds of individuals, the individuals of the 'dextral' and 'sinistral' types, with respect to this feature in one and the same species. Further it is known that the difference between these types is regularly associated with the arrangement of the zoöids on the stolon, the zoöids with the identical asymmetry being attached on the same side of the stolon. I am not certain about how long the above fact has been known; the scarcity of old works for reference has prevented me from ascertaining just who first realized this fact. But, APSTEIN (1894) seems to have been at least one of the earliest authors who clearly observed it. He compares the phenomenon in question with an allied phenomenon known in the inorganic world among crystallographers by the term enantiomorphism, and he has made some attempts

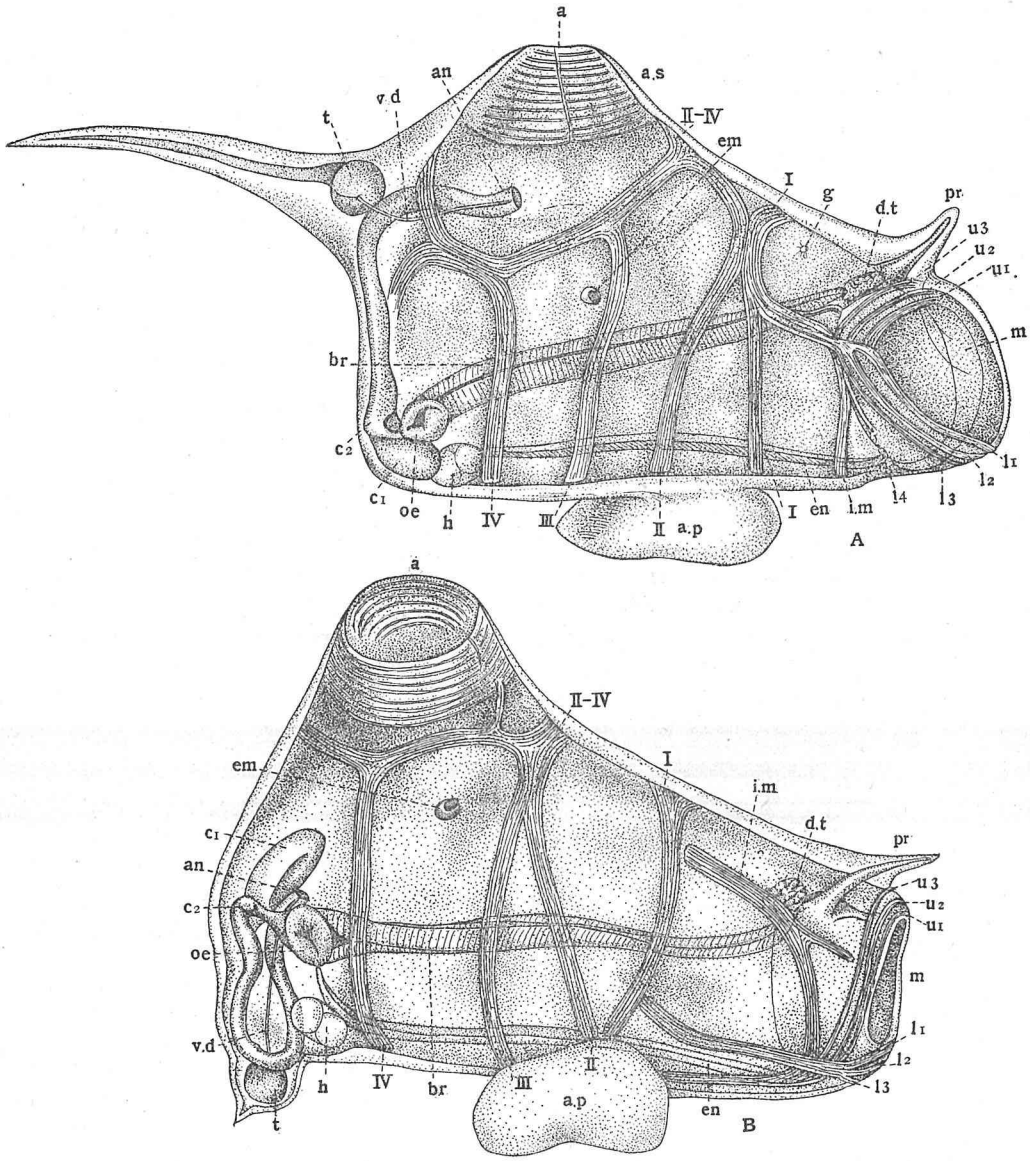

Fig. 7.

Cyclosalpa virgula (VOGT). Aggregated forms. View from right side. × 2. A. Dextral individual. B. Sinistral individual.

to account for its origin. This fact is mentioned also in works by such later authors as IHLE (1912) and METCALF (1918). But always it has been treated only in passing, and nobody seems to have discussed it with

such attention as it merits. So that here I shall endeavor to present it in some detail, by taking the case of *C. virgula* as an example.

As mentioned above, in the aggregated form of this species, the body musculature exhibits a remarkable asymmetry, and the dextral and sinistral individuals form the exact mirror-image of each other. Besides the musculature, the position of the attachment process and that of the horn-like process in front of the dorsal tubercle, are just the reverse of what is found in the individual with the opposite asymmetry. Moreover,

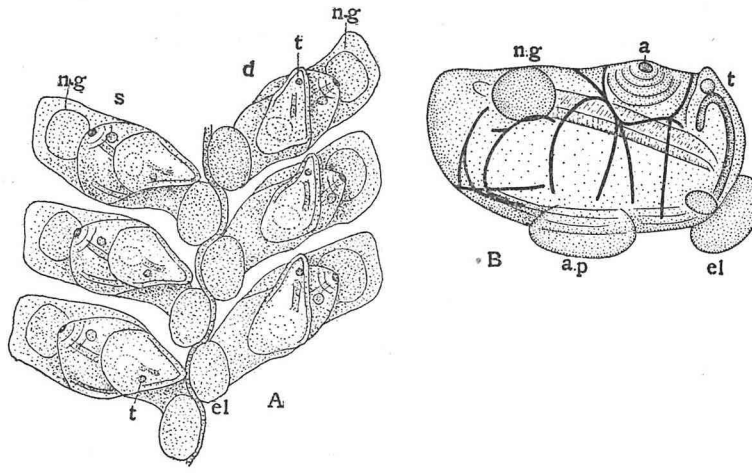

Fig. 8.

Cyclosalpa virgula (VOGT). Zoöids on stolon. A. View from dorsal side of mother. × 35. B. View from the lateral side of a dextral zoöid. × 45.

as already notified by METCALF and JOHNSON (1905), the eye points obliquely outside, that of the dextral individual to the right, and that of the sinistral individual to the left. The asymmetry found in the aggregated form of this species however, is not restricted to these features; it is to be found also in the positions of the embryo, heart, gut, caeca and of the vas deferens. The embryo and the heart are situated on the right side; the oesophageal opening faces to the right, and the anus opens on the left side of the oesophagus, the vas deferens passes to the right side of the intestine, and finally, the caecum on the left side is considerably larger than that of the right.

The asymmetry in these features, however, is to be strictly distinguished from that mentioned first, inasmuch as it is found similarly in both the dextral and sinistral individuals. Thus, for the sake of convenience, it may well be termed the primary asymmetry, to distinguish

it from the asymmetry found in the musculature, etc. which may be defined as the secondary asymmetry.

The structures which belong to the category of the secondary asymmetry develop in the life of zoöids much later than the structures which exhibit the primary asymmetry. As is universally known among the specialists in this group, the zoöids are arranged on the stolon at first in a single row, with their dorsal sides pointing to the base of the stolon. With development, however, the zoöids become rearranged in two rows, right and left. This is brought about by a process in which the alternating zoöids move out to the right and to the left. During this change, each zoöid rotates around its own axis, the zoöids in the right row clockwise, and those in the left anticlockwise. As the result of these changes, the zoöids on the stolon come to be arranged in the following manner. The zoöids make two parallel rows with their oral ends pointing to the ventral side of the mother, and the aboral ends to the dorsal side of the latter, while the dorsal sides of the zoöids face outside (i. e. away from the stolon) and the ventral sides face inside (i. e. toward the stolon).

The rudiments of the heart, ovary and the gut of the zoöid appear in the stage before this rotation and the asymmetry shown by these organs is laid out very early. The musculature and the eye, on the contrary, are formed after the rotation of the zoöids is completed; the horn-like process appears only after the zoöid has been liberated and grown to a fairly large size.

Furthermore, the asymmetry found in the heart, ovary, gut, and gonoduct is found similarly not only in all the species of Salpa, but in the whole group of the Tunicata, except the Larvacea*. Thus, in both the ontogenic and phylogenic senses, the structures belonging to the category of the primary asymmetry are undoubtedly of an older origin, and can hardly be altered by any external influence; those features classified as the secondary asymmetry, on the other hand, are only of a recent acquirement, and this accounts for their comparative plasticity. It is very likely that the zoöids on the right and left sides of the stolon are much like the right and left halves of a single individual of bilateral symmetry, and that they exert mutual influence so that each zoöid moulds the one opposite to it into a mirror-image of itself.

The dextral and sinistral individuals of *C. virgula* further differs in the mode of twisting of the gut, and also in the position of the testis. This is a feature which is apparently restricted to this species only.

* Summaries on this problem may be found in GARSTANG's (1929) and GISLEN's (1930) recent works.

Singularly this difference has never been noticed by previous investigators. It is, however, a rather striking distinction, and there is no exception to the rule among all the 29 specimens examined. Undoubtedly this difference is correlated with the rotation of the zoöids during development. As is stated above, the fundamental condition of the gut of *Salpa* is that it winds from right to left in its course, so that the anus comes always on the left side of the oesophagus. This original twisting may be increased by the sinistral rotation of the portion containing the gut and testis, while it will be undone by the dextral rotation of the same portion. In *C. affinis,* where no difference is found between the dextral and sinistral individuals, all of the zoöids have the shape shown in fig. 3 B. The zoöids on the stolon appear as in fig. 3 A, which shows the view from the dorsal side of the mother, so that the zoöids point their aboral ends to the viewer. The portion which contains the gut and testis of the zoöid appears like a horn, with its tip pointed obliquely up in the dextral zoöid, and down in the sinistral zoöid. If we suppose that this portion goes on rotating independently of the body proper, in the dextral zoöid clockwise and in the sinistral zoöid anticlockwise, then we get a state like fig. 8 A. The difference to be noticed in the posterior portion of the body between the dextral and sinistral individuals of *C. virgula* is probably accounted for in this way.

Abbreviations used in the figures

a . . . . atrial opening.
a.p . . . attachment process.
a.s. . . . atrial sphincters.
c_1 . . . . larger caecum.
c_2 . . . . smaller caecum.
d . . . . dextral zoöid.
d.t . . . dorsal tubercle.
em . . . embryo or its developmental stage.
h . . . . heart.
l_1-l_4 . . . first to fourth sphincter of lower lip.
m . . . oral aperture.
oe . . . oesophagus.
p.b . . . peribranchial band.
pr . . . horn-like process in front of dorsal tubercle.
s . . . . sinistral zoöid.
u_1-u_4 . . . first to fourth sphincter of upper lip.
v.l.m . . ventral longitudinal muscle.
an . . . anus.
a.r . . . atrial retractor.
br . . . . gill.
c.gr . . . ciliated groove of dorsal tubercle.
d.l.m. . . dorsal longitudinal muscle.
el . . . . eleoblast.
en . . . . endostyle.
i.m. . . . intermediate muscle.
l.s . . . luminous stripe.
n.g . . . nerve ganglion and eye.
o.r . . . oral retractor.
p.d . . . peduncle.
t. . . . . testis.
v.d . . . vas deferens.
I–VII . . first to seventh body muscle.

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