cells grow around toward the ventral side at an equal rate; thus the blastopore is formed in the middle of the ventral side. The mesoblasts are carried around with the ectoderm to the ventral side, where they lie at the posterior edge of the blastopore. The mesoblastic bands are soon separated from the mesoblasts; the latter continue to proliferate mesoderm, which extends forward in the lips of the blastopore.

The cross above mentioned resembles very much an arrangement of cells figured by Blochmann [1] for Neritina, the terminal cells in the transverse arms of which are called by him velar cells. In Crepidula it seems that no part of the transverse arms forms the velum. However, the cells of the posterior arm grow very large, the nuclei are vesicular and stain lightly, and the cells become covered by fine cilia, which protrude through a thin cuticula; though at first these ciliated cells lie wholly on the posterior side of the ovum, they move forward in the course of development until they come to lie on the anterior side, and as they increase enormously in size, though they seldom divide, it comes about that they cover the anterior part of the dorsal area, extend around over the anterior end of the embryo and down over its sides. These cells finally form the walls of a large head vesicle.

The velum appears first on the ventral side, just anterior to the mouth, and consists at first of a *single* row of cells. Later it is composed of several rows, some of which are adoral, and at least a single row runs posterior to the mouth. It is not completed dorsally until much later, though soon after the definitive mouth is formed the velum splits on each side of the embryo, and about half way between the ventral and dorsal surfaces, into an anterior and posterior branch; the later continues up over the dorsal surface just posterior to the large ciliated cells; the anterior branch, which is the chief one, turns forward over the sides of the head vesicle, and quite late in development the two arms of the anterior branch meet and fuse on the mid line just in front of the ventral part of the preoral velum. Thus two large velar lobes are formed, one on each side. The posterior branch of the velum appears to be the postoral ciliated band, the anterior branch the preoral; from the corners of the mouth to the middle of the sides of the embryo the two are fused, while ventrally they are separated by the mouth and dorsally by the whole diameter of the head vesicle. A postoral band of cilia has been described as present in the veligers of several gastropods, and among these Crepidula,[2] but I am not aware that any one has hitherto found the two separated dorsally. The velum does not become ciliated until quite late in development, though the embryo swims about in the pouch by means of the cilia of the large ciliated cells which form the head vesicle.

The shell gland appears on the dorsal surface immediately posterior to the second or transverse furrow as a prominence of ectoderm cells. In the place of this prominence an invagination afterward appears; the margin of the invagination extends rapidly and a thin cuticle, the first indication of the shell, is secreted by the invaginated cells. As development proceeds the shell becomes asymmetrical, developing more rapidly on the left side than on the right.

The foot arises as a *single* median protuberance just posterior to the mouth. While it shows no trace of a double origin, it occupies a region along which the blastopore closed, so that really the foot may be considered as having arisen on both sides of the blastopore, though the lips of the latter have fused before the former appears. Running from the mouth backward over the median surface of the foot is a row of large ciliated cells resembling those on the dorsal area.

At the posterior end of the embryo three or four large ciliated anal cells appear, and just ventral to these the distal end of the intestine is pressed against the ectoderm. The proctodeal invagination does not occur until late in development. The intestine is a tube with a distinct lumen, its walls being formed of small cells free from yolk. In the course of development its central end, where it opens into the cavity between the yolk spheres is carried anteriorly and to the right. Throughout its whole length the intestine is pressed closely against the ectoderm.

The supra-oesophageal ganglia appear as proliferation of the ectoderm on each side of and dorsal to the mouth; the eyes are formed in connection with these ganglia as involutions of ectoderm. The ganglia of the two sides are connected by a commissure, and from the centre of the latter a nerve runs forward to the centre of the apical plate, where there is a ciliated depression in the ectoderm, which I believe is a sense organ. A commissure connects the supra-oesophageal ganglion of each side with the otocysts. The latter are formed by involution of the ectoderm of the foot, and the pedal ganglion is formed by delamination from the ectoderm at the sides of the foot.

Urosalpinx cinerea.

The breeding habits of Urosalpinx have been fully described by Professor Brooks.[3] The segmentation is almost identical with that described by Professor Brooks [4] for the oyster, and closely resembles the segmentation of Nassa, as described by Bobretzky.[5] The chief difference between the segmentation in Urosalpinx and Crepidula consists in the fact that while the four macromeres of Crepidula are equal in size, the four macromeres of Urosalpinx are very unequal, one being very much larger than the other three. Two furrows appear simultaneously and seem to divide the ovum into one large sphere and two smaller ones. Really, however, one of the smaller spheres is not completely separated from the larger one, and soon after fuses with it. This smaller sphere is merely a constricted portion of the larger sphere and contains the nucleus. Thus it is seen that of the two furrows mentioned, but one is a true cleavage furrow and it divides the egg into a larger and a smaller moiety. At the next stage the smaller moiety divides into two equal parts, and at the same time two protuberances, each containing a nucleus, are pushed out from the larger moiety. One of these protuberances is cut off to form a macromere equal in size with the two smaller ones; the other protuberance is a part of the larger macromere and again fuses with it. There have thus been formed by two vertical furrows comparable to the first and second cleavage furrows of Crepidula, three smaller and one larger macromere.

The antero-posterior axis of the embryo is no longer coincident with the first cleavage furrow as it is in Crepidula, but in order to preserve bilateral symmetry the axis is shifted to one side, so that it passes through the centre of the larger macromere and through the middle one of the three smaller spheres. This new axis crosses the first furrow at an angle of about 45°, and the "cross furrow" is in this case a true cross furrow, being transverse to the long axis of the embryo.

The micromeres are formed very much as in Crepidula. The ectoderm extends posteriorly over the large sphere much more rapidly than it does anteriorly over the three smaller spheres, and the blastopore closes almost directly opposite the formative pole and at a point where the four macromeres meet in the centre. At this point the definitive mouth afterward appears.

Owing to great difficulty in cutting sections of the Urosalpinx egg its development was not carried farther.

Notes on the Physiology of Caravella Maxima, Haeckel (*Physalia Caravella*, Eschscholtz). By Robert Payne Bigelow.[6]

During July and the early part of August of the year 1889, Caravellae, Portuguese Men-of-War, were unusually numerous in Vineyard Sound. As during that time I was at the U. S. Fish Commission Station at Woods Holl, I was able to collect, from time to time, a number of specimens for study; and in the large hatching tanks there, kindly set apart for my use, I could keep these animals alive for a week or more.

Behavior when Undisturbed.

(a) General Movements.

The first thing one sees on looking at a Caravella is the large bladder-like float, pneumatophore, which lies on the surface of the water, usually

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1 F. Blochmann, Ueber die Entwicklung der *Neritina fluviatilis.* Zeit. wiss. Zool., Bd. 36.

2 McMurrich. J. H. U. Circulars, No. 44, 1885.

3 Preliminary observations on the development of the Marine Prosobranchs. Studies from the Biological Laboratory, J. H. U., Vol. 1.

4 The Embryology of the Oyster. Studies from the Biological Laboratory, J. H. U., Vol. 1.

5 N. Bobretzky. Studien über die Embryonale Entwicklung der Gasteropoden. Archiv. f. Mik. Anat., Bd. 13.

6 A preliminary abstract of this paper was published in J. H. U. Circulars, No. 80, 1890.

with its crest laid over on one side (see note). Hanging from the posterior half of the right margin of the ventral surface of the float—taking the apex to be anterior, and the crest to be dorsal—is a multiple series of thickly set cormidia. The immensely long main tentacles, several yards in length, are attached to the float by simple, unbranched pedicels and hang down vertically from the right side of this series of cormidia.

If the Caravella be placed in a tank with transparent sides, on looking at the animal one is immediately struck with the motions of its appendages. They seem to be in a constant state of activity. The large tentacles are always being retracted and extended; and the cormidia are being raised and lowered by the contractions of their peduncles,[1] sometimes separately, sometimes in a sort of unison. This motion is compounded by the separate raising and lowering of the secondary clusters of the cormidia, due to the contraction of the branches of the peduncles. With all this, the siphons and small tentacles of the feeding cormidia and the palpons—mouthless siphons—of the gonodendra are perpetually squirming, extending, and contracting. Looking more closely, one sees that all of the appendages are not often in activity at once, in fact usually only very few are, but there is always some cormidium being raised and lowered, some siphons and palpons squirming and twisting.

If one watches the Caravella for some time, there will be noticed occasionally uneasy movements in the float, a sort of squirming motion, especially when there is a general contraction of the appendages. Perhaps this will be followed by a general shortening of the float, then the apex will be raised above the water by the contraction of muscles of the left side; following this, the left ventral muscles will contract, thus shifting the centre of gravity, and the float will roll over through an arc of ninety degrees, bringing the crest upright. The float may remain a long time in this position, but more often the centre of gravity is soon shifted to the opposite side by the contraction of the muscles of that side and the crest falls over on the water again. The float cannot lie on its left side owing to the position of its appendages.

There are long intervals usually between the contraction of each tentacle, and no rhythm was observed in these motions. The peduncle would often contract without the contraction of the tentacle proper, but the latter does not seem to contract except when the former does. The wave of contraction can be seen to travel downward from the peduncle. The relaxation seems also to start from the same point.

The motion among the cormidia consists chiefly of contractions of the pedicels. There is also some motion in the individual polypoids and secondary tentacles. The motion of the small tentacles is like that of the large ones, viz., a contraction which starts at the base and goes downward, resulting in a progressive partial or complete coiling of the tentacle. The movement of the siphons and palpons is, as already implied, a squirming motion, accompanied sometimes in the former by a peristaltic contraction going from the mouth.

(*b*) *Rhythm.*

At first sight there appears to be no regularity in the movements of the cormidia. Sometimes they will contract separately, at other times together in a rough unison. But if one observes them for some time with the aid of a time-piece, the movements will be seen to be rhythmical. Below is the result of a continuous series of observations made on a single gonodendron in a specimen that had been kept in one of the tanks for two days in good condition. The figures are the numbers of contractions observed during intervals of fifteen seconds, the whole time represented being thirty-five minutes: 0 0 0 2 3 2 2 2 0 0 0 3 2 3 0 0 0 1 3 1 0 1 2 2 1 0 0 1 0 0 0 0 0 3 2 2 2 2 2 2 2 2 2 2 2 1 1 2 2 1 0 0 0 0 0 0 0 0 1 3 3 0 0 0 0 0 3 3 1 0 0 0 0 0 0 0 1 3 2 2 2 2 1 0 0 0 0 0 0 2 2 2 2 0 0 0 0 0 0 0 0 0 3 3 1 3 2 1 0 0 0 0 0 0. It will be seen that the number of contractions in each interval is pretty constant, and that the periods of rest are fairly regular in length. The rhythm would probably have appeared more marked if I had had some instrument beating seconds by which I could have counted the number of seconds between the contractions.

EFFECTS OF UNFAVORABLE CONDITIONS.

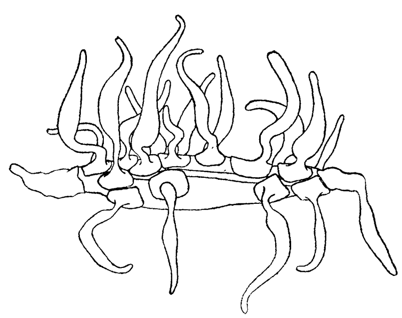
When the animals were brought in from the launch there was always found in the bottom of the jar a number of detached gonodendra, siphons, and pieces of tentacles. These detached parts retained their normal powers of movement; to a slight degree in the tentacles, more strongly in the gonodendra, and to a marked degree in the siphons. The gonodendra were always broken off whole, while the siphons usually came off separately. It was found that any violent agitation would cause this loss of members, and exposure to unfavorable conditions without any violence would produce a similar effect. After the animals had been kept in the tanks several days undisturbed, the siphons, gonodendra, and occasionally a part of a tentacle would begin dropping off. These behaved just as those did that were shaken off by violence. The detachment of a siphon seems always to occur at the same point.

Although my specimens of Caravella were kept in what seemed a large quantity of running sea water and were fed, I did not succeed in keeping them alive over ten days; possibly the feeding was not carefully enough attended to. My first specimens were obtained July 23. On the 29th opaque areas appeared on the floats of all but two of them. In these areas the muscles appeared to be in a state of *rigor mortis*, or at least in a very severe spasm. In those specimens in which these areas were especially well marked the gas in the floats was in a state of unusually high tension. July 30th, four specimens were found with their floats collapsed. In one this state of affairs was evidently brought about by the bursting of the pneumatocyst, for the peduncles were distended by the gas. August 1st, two more specimens were found collapsed and with nearly all of their appendages detached and lying on the bottom of the tank; but as on the day before, the members that remained attached to the float were active. The water in the tank seemed to contain a great deal of the poison peculiar to these animals. After I had cleaned out the tank my arm felt as if it had been stung, although I had not touched one of the tentacles. Of the two remaining specimens, one was found collapsed on the following day; the other one, the smallest one taken July 23d, had its float in almost perfect condition but had lost nearly all of its appendages. The larger specimen was tried and was found still capable of taking food in the usual way. This day two fresh specimens were put into the tank, and on the following day I left Woods Holl for a short journey. Returning August 9th, I found the water in the tanks foul from the decay of detached appendages and the animals dead or nearly so, with the surface of their floats dry and parchment like.

At the apex of the float the position of the stigma is well marked. According to Haeckel, it is capable of being opened or closed at the will of the animal. L. Agassiz says he has never seen it opened and my observations seem to show that this cannot be done voluntarily.

METHOD OF CAPTURING PREY.

Several times specimens were brought in whose siphons were filled with food. One specimen had several partially digested pieces of small fish attached. The least digested of these fish was a silversides—*Menidia notata* (?)—nearly whole. It was 8.5 cm. long and was held by over fifteen



Fish with siphons attached as it fell from the caravella. × ½.

siphons. The soft parts of the integument, head, fins, and tail were completely digested. The mouths of the siphons that were attached to any projecting part, as the head, tail, or a fin, would completely envelope that part. The mouths that were attached to a flat surface were spread out widely so that their edges touched each other. Probably the whole surface of the fish was covered by these mouths, but I could not be certain of this, because as soon as the siphons became detached from their cormidia they began to contract.

[1] It may be convenient to borrow from botany the term peduncle for the main stem of the cormidium, and pedicel for its ultimate branches.

Small fish, then, seem to be one of the natural foods of these animals. In order to see how they are captured I put two minnows 6 to 7 cm. long, into a glass jar with a Caravella. The two fish darting about, the smaller one soon struck its side against one of the main tentacles with such force as to wind the tentacle about his middle. He gave one spasmodic jerk, then doubled up paralyzed and, the tentacle contracting, he was drawn up among the cormidia. Soon after this the larger minnow ran his head against a couple of large tentacles, feeling the sting he darted on, only to have the tentacles become fastened all along his side. After a brief but violent strnggle the minnow suddenly became motionless and was instantly drawn up to the siphons. These, when their mouths touched either minnow, became quickly fastened to him. After recovering from the shock of the capture both of the fish made considerable resistance, but in each interval between their struggles more siphons would be attached and the fish more firmly held. Gradually their struggles became more and more feeble and in about an hour the fish died. The Caravella was then returned to the tank.

Parts of the fish were found next morning at the bottom of the tank in a very much macerated condition. A freshly killed fish which had been put into another tank at the same time was still quite fresh looking, showing that in the first instance it was a process of digestion, not one of decay.

While the conflict between the fish and the Caravella was being watched, several of the siphons were seen to attach themselves to the sides of the glass jar. This occured on several other occasions, but seemed most marked when the animal was taking food.

This experiment of feeding the Caravella was repeated a number of times. A minnow about 6 cm. long was put into a jar with a specimen that had been in the tank for six days. The minnow swam about rather quietly. It soon, however, struck a tentacle with its head, but only so that about one centimeter of the tentacle was attached to it. Although the attachment was so slight, the fish was unable to shake it off. At the same time, the single tentacle was unable to pull in the fish so long as it resisted. At length, the fish becoming fatigued, its struggles became intermittent. While the minnow struggled the tentacle was unable to pull it in, when its efforts ceased the tentacle likewise relaxed. The fish seemed in a fair way to escape being eaten, when in one of its paroxysms of activity it ran against another tentacle and was immediately drawn up so that a few of the siphons could become attached. As the tentacles gradually let go their hold, these siphons held the fish, and, contracting from time to time, they brought it into contact with the mouths of other siphons, one or more of which would become attached with each contraction until the animal was covered by their expanded mouths. A shrimp was also put into the jar but failed to be caught, although it several times came in contact with the tentacles.

I tried touching a tentacle with my finger and in imitation of the minnow drawing the finger through the water away from the Caravella. The tentacle would remain fastened to the finger but its pull was not preceptible. On allowing, however, the finger immediately to return towards the animal the tentacle would contract. In this experiment the tentacle became so firmly attached that it had to be scraped off with a knife. As long as the tentacle only touched the palmar surface of the hand there was no unpleasant sensation, but if it touched the arm or the back of the hand the sensation was very painful, quite like the sting of a bee (see note).

Effects of Stimulation.

(*a*) *Food as a Stimulus.*

The tentacles are not stimulated by contact with food. Several of my experiments show this. A Caravella was in a glass jar and the ends of its long tentacles formed a tangled mass at the bottom of the jar. On this mass of tentacles there was quietly laid a piece of fish. There was no reaction. By the usual occasional contractions of the tentacles they were gradually drawn out from under the piece of fish, but none became attached to it. The same experiment was tried with a piece of shrimp, with the same result. A small minnow, 4 cm. long, was put into this jar. The minnow struck a tentacle with its head, was seized and the tentacle contracted. But before the fish reached the siphons it ceased its struggles and the tentacles relaxed. After some time it again struggled and the tentacle was partially retracted, but the minnow again becoming motionless, the tentacle again relaxed. The minnow lay for a good while motionless on the mass of tentacles at the bottom of the jar; the hold of the tentacle was gradually loosened, and at length the minnow swam quietly away.

The siphons, on the other hand, are stimulated by proteids or, at any rate, by something in animal substances. In order, however, to react to this stimulus, the siphon must first have its mouth in close contact with the food. To test this, I held a number of small objects so that they would come in contact with the mouths of siphons. The siphons would attach themselves to almost anything, but when attached to a piece of fish or mutton the mouths would spread over the object and the siphons would repeatedly contract so that other siphons could become attached. If, on the contrary, the object was of inorganic material, as a piece of glass or shell or a small stone, the mouths of the siphons would not be widely spread over it, and they would soon detach themselves from it.

(*b*) *Mechanical Stimuli.*

Scratching the float with the point of a needle causes a local contraction of the muscles. Squeezing the float with the hand produces a contraction of the whole animal. A strong stimulation of the peduncles of the tentacles or of the cormidia is followed by a general contraction.

Stimulating the peduncle of a tentacle causes it to be wholly retracted, and the same result follows any pull on the tentacle. Gently pushing the tentacles or the whole animal about with a glass rod has no effect, but if a tentacle is wound around the rod and then the rod quickly moved away from the animal, the tentacle is contracted. The results of stimulating the tentacle are not very definite. Pinching the tentacle is sometimes followed by its total withdrawal; more often the effect of the pinch is merely a local contraction, or it may be a contraction progressing downward from the point stimulated. Often in the case of a total contraction a small contraction may be first observed at the point of stimulation, then the larger contraction may be seen to start from the peduncle and quickly involve the whole tentacle. The effect is the same whether the chain of cnidonodes or the muscular part is irritated.

(*c*) *Effect of Wind and Rain.*

I was told by fishermen that the Caravella will erect its crest when the wind blows (see note). To see if this were so, I tried the experiment of directing a stream of air, by means of a pair of bellows, against the float of a fresh specimen in one of the large tanks. The first effect was a general shortening of the float, then it contracted on the side toward the stream of air, then on the other side. This squirming motion continued for a few minutes, when by the contraction of the muscles on the left side,—the lea side in this case,—the sail was erected. Soon after the stream of air was stopped the muscles relaxed and the crest was laid again flat on the water. This experiment was repeated several times. On one specimen freshly brought in, the erection of the sail was more prompt. It was accomplished on three trials in 7, 10, and 15 seconds, respectively, after I began to work the bellows. At first the animal would relax very soon, in say 10 or 15 seconds after the crest was erected, the stream of air in the meantime being continuous. After several trials the crest remained erect for 70 seconds, and finally at the last trial I stopped working the bellows after two minutes, the crest being still erect.

In order to see if the float was sensitive to fresh water I made a series of experiments on two specimens. These were sprinkled by hand with fresh water. The effect was similar to that produced by the current of air, except that in one specimen the contraction of the muscles was much stronger. Between the sprinklings with fresh water, the animals were sprinkled in the same way and with the same quantity of sea water, and remained perfectly quiet. The movements of the float described in the first section of this paper may be due to an irritation caused by the drying of its surface.

Effects of Section.

The immediate effect of section is a strong local contraction sometimes accompanied by a contraction of the whole animal. After recovering from the shock, the severed parts show their normal spontaneous movements and respond in the usual way to stimuli. One of the large tentacles was cut off with its peduncle and suspended in a jar of sea water, it there exhibited its normal movements, but was not very active. It was then cut in two and spontaneous movements were observed in both parts, but they were much less marked in the distal part. Parts that break off spontaneously will remain active for a long time, 24 hours or longer. A number of the detached siphons were cut in various ways. All the parts, even the smallest, about one mm. long, were found capable of moving spontaneously. A float with all the tentacles and cormidia removed, only the stumps of the peduncles remaining, showed likewise its normal power of movement.

SECRETIONS.

Four different fluids, at least, are secreted by Caravella.

1. The surface of the float is covered by a mucous secretion. This is quite apparent to the hands in fresh specimens.

2. There is a very viscid fluid secreted at the mouth of the siphons, by which they first attach themselves to foreign bodies. A thick drop of it may generally be squeezed out of the mouth of a siphon.

3. The siphons secrete a digestive fluid, as is evident from the effect produced on food substances.

4. The cnidocells secrete a poisonous fluid which produces a very painful sensation on the human skin and causes a temporary paralysis in a small animal, and finally in some cases death.

5. There may be added to this list the gas contained in the pneumatocyst, which is probably a secretion.

SENSES.

The sensibility of the animal under consideration is very low. Impulses or sensations may be transmitted from one part to another, as is shown by the effect of a severe stimulus and by the action of the float under the influence of a stream of air. It is difficult, however, to see how there can be any real senses without a central organ to preceive the sensations, and I find no evidence of such a structure except that the waves of contraction of the tentacles appear to start normally from the peduncles. This indicates at least a motor centre, but my experiments are not at all conclusive.

I could not find any evidence of a sense of smell. A piece of freshly killed fish was suspended for half an hour within half an inch of a cluster of siphons without their seeming to perceive it in the least. Repeatedly I presented the fish as near to the siphons as I could without touching them, with no effect. Touching the side of the siphons with the fish was followed by no response, but if the fish was allowed to come in actual contact with the mouth it was held fast. A small stone and a piece of apple soaked in sea water were held close to the mouths of the siphons. None were attached to the apple, but after a few minutes three siphons became firmly attached to the stone and remained attached for fifteen minutes, then the stone was allowed to fall.

The siphons seem to discriminate in a slow sort of way between what is food and what is not; spreading themselves out over the former, and soon letting go of the latter. This may be due to a sense of taste, or to the chemical stimulus of the food or of the first products of its digestion. Eyes and ears are absent.

SUMMARY.

As is indicated by the title, this paper does not pretend to be a complete exposition of the physiology of Caravella. Nevertheless, it may be well for the sake of clearness to sum up now in a short account of the mode of life of this animal the chief points indicated by the observations here recorded.

In *Caravella maxima*, then, we have an animal without any sense of sight, hearing, or smell; and with little or no sense of taste or touch. It has only a trace of coördination in its movements, in which there is a certain amount of rhythm, and every part is capable of originating an impulse. Impulses, however, arising in one part may be transmitted to another part. This animal floats on the surface of the ocean and is passively carried about by the winds and currents. The only active part that it can take in its locomotion is to erect its sail when a breeze strikes it, or to heave to in a gale with its tentacles deeply extended into the water. If it rains, the float may be turned over so as to wash off the irritating fresh water.

For food this animal captures small fishes. It floats there on the sea, quietly waiting for some heedless individual to bump its head against one of its tentacles. The fish, on striking, is stung by the nettle cells and fastened, probably by them, to the tentacle. Trying to run away, the fish pulls on the tentacle. The tension on its peduncle, thus produced, acts as a stimulus on apparently some centre there, which sends an impulse along the tentacle that causes it to contract. The fish in this way is drawn up so that it touches the sticky mouths of some of the squirming siphons, or feeding polypoids. As soon as the mouths, covered as they are by a gluey substance and provided with nettle cells, touch the fish they stick fast, a few at first and gradually more. The mouths open and their lips are spread out over the fish until they touch, so that by the time he is dead the fish is enclosed in a tight bag composed of the lips of a dozen or so of siphon mouths. Here the fish is digested. As it begins to disintegrate, partially digested fragments are taken into the stomachs of the attached siphons. When they become gorged they detach themselves from the remains of the fish, the process of digestion is completed in the stomachs, and the nutrient fluid is distributed through the hollow pedicels and peduncles to the other parts of the animal, or, in more technical language, to the other members of the corm.

NOTE.—While employed on board the U. S. F. C. schooner Grampus during the past summer I was able to make a few observations on this interesting animal while it was still in the warm water of the Gulf Stream. These show that in observing specimens taken near shore one must allow for a certain amount of debility. The animals when we sailed by them in the Gulf Stream, instead of having their crests lying flat on the water as in the tanks at Woods Holl, usually held them erect. When they were relaxed it was only for a very short time. The colors of the animal are much deeper and more brilliant than in the Woods Holl specimens and the poison of the tentacles was many times more virulent, as I found to my personal discomfort. In my experiments in feeding the Caravella I only used medium sized minnows. Mr. Conley, Second Mate of the Grampus, informs me, however, that on fishing vessels it is common when they come across a Portuguese Man-of-War to put the animal in one of the small boats which is filled with water on deck and then throw in full grown mackerel freshly caught, in order to see the resulting struggle, and that the Caravella easily captures the fish. Mr. Conley also said that he was made very ill by picking up the first specimen that he saw, so much so that he was unable to work for several days afterward. His hands at the time were sore from the chafing of fishing lines. I found that the merest touch of the back of the finger to one of the tentacles of these Gulf Stream specimens would produce the most intense pain.

Preliminary Notes on Some New Species of Squilla.

By R. P. BIGELOW.

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The Stomatopods taken by the U. S. F. C. Steamer Albatross, on her cruise to the Pacific in 1887–88, and during her subsequent work in that ocean, were turned over to Dr. Brooks for study, and he has asked me to undertake this work under his supervision. I am alone, however, responsible for the details of the work, and therefore for errors, if any occur.

So far, I have confined my attention to the specimens of Squilla, and while studying these I find it convenient to make a complete rearrangement of the species of that genus as it is defined by Dr. Brooks in his report on the Stomatopods of the Challenger. It would be premature, however, to publish that until the collection is finished. Of the Squillas received up to this time there are five species, of which all but one are new, and the purpose of the present paper is to give a brief preliminary description of these.

Squilla polita n. sp.

The eyes are of moderate size and triangular. The dactylus of the raptorial claw is short and has four stout teeth; the rostrum is ovate and without carinae. There are no carinae on the caripace except on the posterior lateral lobes, which are evenly rounded in outline. The anterior lateral angles are acute. The cervical suture is obsolete or entirely wanting on the median line. The marginal spines of the second thoracic segment, following Dr. Brooks' terminology, are broad and blunt and curved forward. The lateral margins of the third and fourth segments are rounded without spines. There are no submedian carinae on the dorsal surface of the thorax or abdomen, except on the sixth abdominal segment; the telson has its dorsal surface ornamented by a median crest and a few symmetrically curved lines of shallow pits. There are six large marginal spines, of which the submedian pair are jointed. Of the secondary teeth there are,—submedian 2–3, intermediate 9–12, lateral 1. There is a very conspicuous rounded tooth on the outer side of the inner process of the prolongation of the basal joint of each uropod.