

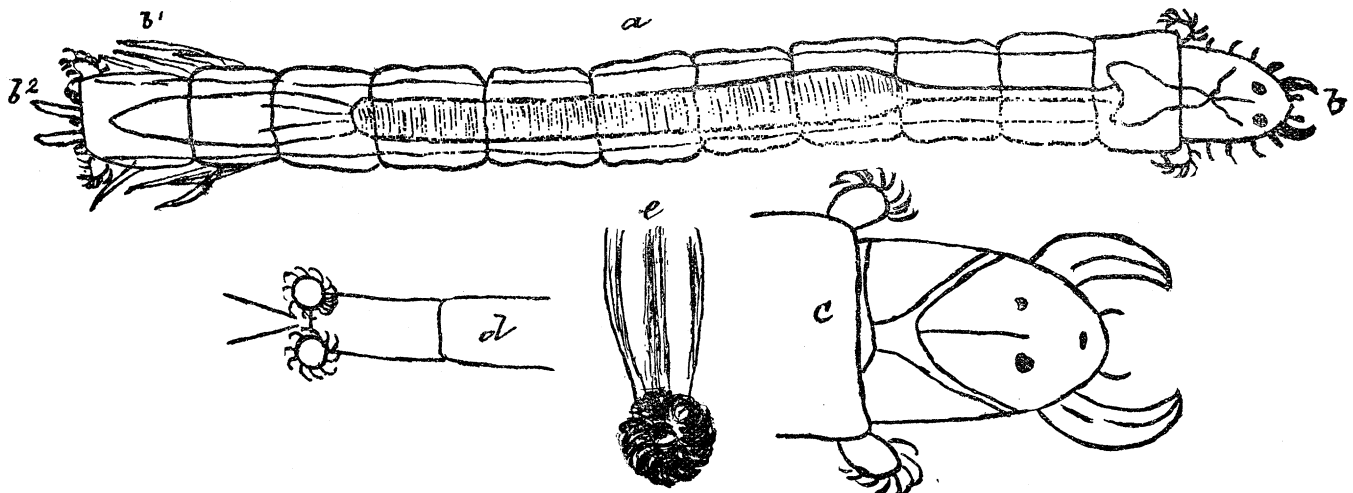
NOTES ON MARINE AND FRESH WATER LARVÆ OF MIDGES.

BY GEO. SWAINSON, F. L. S., ST. ANNE'S-ON-THE-SEA, ENG.

DURING the past two years Professor Miall, F. R. S., has been lecturing before the British Association and elsewhere on "Some difficulties in the life of aquatic insects," and especially instancing the larva of the dipterous fly *Chironomus*. My interest in this lecture when heard at Cardiff was heightened by the fact that I had on three occasions captured a marine larva very closely resembling his *chironomus*. This was included by Dr. Johnston amongst the British Marine Annelids under the name of *Campontia cruciformis*. (*London Mag. of Nat. Hist.*, Vol. 8, p. 179, Nov. 13, 1884, and "Johnston's British Worms."). That *campontia* was a dipterous larva was suspected by both McLeay and Green, the latter because he captured a fresh-water *chironomus* larva, and noticed its resemblance to *campontia*, and observed its metamorphose into the pupa stage, but the fly escaped him, and this fresh-water genus remained unspecified. This was in 1837, and since that time no one in England seems to have taken the trouble to find out *campontia*'s fresh-water relations.

tute, Vol. 6, p. 42). I have carefully compared my specimens with the drawings given by Dr. Packard, and it is quite certain they are not the same species, the mandibles being slightly different, but more particularly the hooklets or retractile claws on both the fore and hind feet are very different, and the respiratory tubules possessed by *campontia* are not visible on the American species.

The great difficulty I experienced in finding any one in England to assist in naming this and other species of *chironomus* larvæ I have met with, in a large measure prompted me to write this paper. I have applied to many of the principal authorities on diptera, only to find that there are several families in which the life history of only a very few species has been worked out. Surely there are many excellent members of our microscopical societies throughout England who only need to have the fact brought home to them to induce them to make some attempt, however feeble, to fill up this gap, especially as the subject is a very interesting one, and the material abundant. The difficulty of obtaining specialists to undertake the work of describing many groups of insects has been recently referred to by the editor of *Natural Science*, for he states that, though Mr. Whympers "Trav-



CAMPONTIA CRUCIFORMIS (A SUPPOSED ANNELID WORM).

- a. Natural size.
- b. Magnified.
- c. The head slightly compressed between plates of glass.

- d. Under side of the anal segment.
- e. Hooked sucker foot from Mr. Swainson's microphotograph.

In October last, on our Golf links at St. Anne's-on-the-Sea, I found several larvæ of *chironomus* fully grown in its splendid blood-red color. These I kept during the winter, and watched their metamorphoses in small glass jars, with the tops covered with muslin. They ultimately proved to be *C. dorsalis*, and their resemblance to *Campontia cruciformis* in all but color is most remarkable. The hæmoglobin, which colors the blood plasma in the "Harlequin" larva so beautifully, is replaced in the marine form by a light sea-green pigment with which the fat cells are colored. The mandibles and two pairs of retractile hooked appendages, or pro-legs, are very similar to *C. dorsalis*, and especially the respiratory tubules at the posterior, and I had therefore no doubt as to *Campontia cruciformis* of Johnston being a dipterous larva of the *chironomus* genus. I found this larva several times on the obelia zoöphytes growing at the end of St. Anne's Pier, Lancashire, England. Next I found it on some coryne from the Mumbles, Swansea, and more recently I dredged it from fifteen fathoms depth off Spanish Head, Isle of Man, adhering to seaweed. Dr. Packard, of America, has recorded the discovery of a marine dipterous larva in fifteen fathoms off Salem Harbor, which he has named *Chironomus oceanicus* (see Transactions of Essex Insti-

els amongst the Great Andes of the Equator" was completed twelve years ago, the volume in which the zoölogical collection was described, has been only recently issued, and this with several large groups of insects omitted, and no one has been found able to describe them. Professor Miall, to whom I sent my specimens, thought it would ultimately turn out that Johnston's *campontia* was Schiner's *Thalassomyia frauenfeldi*. This may prove to be so, but, again, Schiner only records the capture of the female fly and gives no account of the larvæ in his "Fauna Austriaca" (p. 596, Vol. 2). This species is British, for Mr. H. N. Ridley, of the British Museum, captured both the male and the female flies in a cave in the Isle of Wight (*Entomological Mag.* for 1884), and I think it is the same fly I have seen more than once on our pier end at St. Anne's-on-the-Sea, but did not succeed in capturing them. There is no drawing published yet, I believe, of *Thalassomyia frauenfeldi*. I have twice tried to rear *Campontia cruciformis* in a small salt-water aquarium, but unsuccessfully. It seems quite certain that the larvæ of these diptera do inhabit salt water, for Agassiz speaks of them in the "Cruises of the Blake" as being commonly met with off the North American shores.

Leaving these species for future identification, I must

now record the discovery of three species of the larva of the fresh-water *chironomus* new to science, and drawings of which accompany these notes, together with that of another new form found only last week by my friend Mr. A. R. Hammond, F. L. S., on the leaves of potamogeton, forming small tunnels therein. I have made a few mounts of all these species, which will very likely prove to be larvæ of well-known species of flies described by Walker and listed by Verrall, there being over 250 different species of chironomidæ in Britain, while the larvæ of only some dozen are known. Up to the present time the best work on these and similar "eucaphalous" larvæ is that of Prof. F. Meinert, published by the Royal Society of Copenhagen in 1886, full of splendid plates of the larvæ only of fresh-water species, but it is in Danish, and I do not know that it has been translated. None of these new specimens are included therein, and Mr. Hammond, who is well up in the bibliography (he is now bringing out a paper in the transactions of the Linnean Society and shortly to be published on the structure and life history of *Chironomus dorsalis*, in collaboration with Professor Miall), informs me that he has not met with any drawings or description of these larvæ of mine. I may add that Dr. Johnston's drawing of *camponotia* does not show the two pairs of long respiratory tubules which the larva can protrude from the eleventh segment and retract again. These are, however, shown very clearly in the micro-photographs of my mounts of *camponotia* and *Chironomus dorsalis*. Mr. Slater describes these as being also seen in *C. plumosus* (Ent. XII., p. 87). They are clearly shown in Meinert's drawings as possessed by *C. plumosus* and also by *C. venustus*, but this latter is believed to be the same species as *C. dorsalis*.

In conclusion, I must not omit to make a note of what I feel sure is an instance of the very interesting development known as *parthenogenesis* in connection with *C. dorsalis*. One of the larvæ, fully grown, was put in a bottle late in October, 1891. It sickened and died, but before its death there came forth from the body a large number of young *C. dorsalis*, which ultimately became fully developed, though not so large as the other imagines. The bottle containing them was in a cold room, and they all appeared in the winter before the end of February, and so could not possibly be hatched from eggs laid prior to October. I watched these most sedulously through the pupa state, for they spun their pupa cells on the under side of leaves, and not in the mud at the bottom of the glass, like the ordinary *Chironomus dorsalis*, waving their heads about in the curious way described by Meinert. They did not assume the strong, deep, blood-red color either, being nearer the surface of the water. There is no question about the flies being *C. dorsalis*, as I have now one or two in spirits of wine. Finding that Mr. Oscar von Grimm had recorded the fact that the pupa of *chironomus* laid eggs prepared in the body of the larva, these ova being deposited in rows of long threads, just as the female *C. dorsalis* does, only that they are protruded through two small holes above the anus of the pupa. I therefore watched the older non-parthenogenetic blood worms most carefully, when they emerged from the larval into the pupal state, and I must say, that never did the proceeding take place, as far as I could see, and during the following month there were no young larva of *Chironomus dorsalis* produced. It is quite evident that further investigation and the closer watching of the life history of these midges will fully repay entomologists, for it is hardly possible to think, after Mr. Grimm's careful and detailed investigations, that his young larvæ were parthenogenetically produced.

LETTERS TO THE EDITOR.

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A SPACE-RELATION OF NUMBERS.

MR. D. S. MARTIN'S article under this head, in *Science* for August 11, is of peculiar interest to me in touching upon a mind experience which I had supposed an idiosyncrasy of my own, since I have been unable to find another person who had any similar experience, except my own mother. I am glad to find another person of a like mind, since it is an indication that it may not be an exceedingly rare experience.

I date the origin of my idea at the time when I began to learn to count, which was at home, by the "purely abstract and memoriter" system. Not only are the numbers from 1 to 100, but from 1 to infinity, and all the fractions in a less degree, conceived of by me "as holding, relatively, definite positions in space, from which they never vary." It is simply impossible for me to think of a number except in its relation to the other numbers and in its position in the scheme.

In my mind the numerical position bears no relation to that of any other object or thing, nor to the position of my body; but it does bear a definite relation to the points of the compass. Beginning at my feet the numbers 1 to 10 run due west in a slightly ascending line, 10 being a little beyond and above 9, with 5 above and beyond 4 so that it is given greater prominence. 10, 11 and 12 are arranged in an ascending spiral. 12 is above the plane of 1 say six inches. 12 to 15 are in a horizontal plane in a straight line running W. N. W. 15 to 19 changes to W. by S., slightly ascending, with 20 directly above 19, and about 8 inches above 1. 20 to 30 runs due S. 30 to 60 is a zizzag, 30 to 40 running due E., 40 to 50 S. E., 50 to 60 E. by S. The whole line ascends so that 60 is eighteen inches above 1; but from 20 to 55 the incline is uniform, while from 55 to 60 it is enough more abrupt so that the perpendicular distance from 20 to 55 is just equal to that from 55 to 60, 60 being directly above 59. 60 to 70 runs due S., 70 to 100 S. S. E. 100 is twenty inches above 1. In the whole scheme from 20 onward the multiples of ten are elevated a little above the numbers immediately following and preceding, so that they are more prominent. From 1 to 100 the numbers get more and more distant and indistinct, and consequently appear smaller as they increase in value; but the twenties and fifties seem plainer, but not larger, than the others, as though they were in the direct sunlight, and the others partly shaded. From 100 I drop back to 1 and repeat the course for every succeeding hundred.

The hundreds from 100 to 900 (but not with their units and tens) are arranged in a straight line tending W. by S., scarcely if at all ascending. 1,000 is directly above 999. 1,000 to 1,000,000 is an indistinct line curving upwards towards S. E. by E. From 1,000,000 onward the tendency is upward and in a S. W. direction; but here a haze envelops the numbers so that they are ill defined and hard to follow.

I conceive of the numbers as being of the same size, but appearing to vary in size as their value in reverse order on account of their distance from the starting point. Therefore in giving perpendicular distances I have given them as they would appear on a chart and not as actual distances. The sense of the true perspective is perfect.

In the application of this scheme to every day use it is