

### Letters to the Editor.

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#### Earth-worms, Mud-worms, and Water-worms.

I GATHER from various correspondents that the word "earth-worm" requires some elucidation if we are to avoid misconception. I venture to submit the following statement. The Chætopoda, or bristle-footed worms—often called the "Annelids"—form one of the three large branches of the phylum Appendiculata. The Arthropoda (=Gnathopoda) and the Rotifera are its two other branches. The Chætopoda are divisible into the class "Polychæta" (all marine) and the class "Oligochæta"—containing very few marine forms, and inhabiting either the slime and mud of fresh-water pools and streams, or the loose, damp "humus" or "earth" of the land-surface.

I think that the opinion expressed by Mr. Coste (in his valuable letter in NATURE of May 19, p. 360), to the effect that "the moist surface" of worms inhabiting the soil "must, when underground, frequently or usually be in contact with other moist surfaces, so that the worm is, in effect, partly immersed in water," involves a mistake as to the condition of the earth thus inhabited and the size of the burrow made by the worm. The earth inhabited by earth-worms is *not* slime or mud, and does not fit closely to the worm's body as would a semi-liquid mud or soft clay. It is, on the contrary, a loose aggregation—the solid particles of which are largely separated by atmospheric air—and the worm's body does not fit tightly to the walls of its burrow, although a mucous exudation from the worm's surface is often deposited on those walls. An earth-worm in movement is continually changing its dimensions—elongating and becoming narrow, shortening and becoming wider. Hence there is no "immersion" of the worm's body in liquid or semi-liquid material. On the contrary, air has continual access to the worm's surface through the porous soil; and the change in its diameter and its movements must cause the movement of the air in the space between the worm's body and the wall of its burrow. It seems to be necessary to bear in mind the distinctive physical features of the earth or surface soil in which the earth-worms make their burrows—as contrasted with either the water or the mud—practically a liquid—in which other Oligochæta pass their lives.

The Oligochæta are divided into four orders, namely, the Naidiformia, the Sænuridiformia, the Lumbriciformia, and the Hirudiniformia (or leeches). The first of these is a very distinct group inhabiting fresh-waters (only two British species are marine). They are much smaller in size than the others, and are characterised by young forms which reproduce abundantly by bud-fission, and are succeeded by a distinct adult sexual form. The Sænuridiformia and the Lumbriciformia are closely allied—the former being as a rule smaller, more elongate, and more agile in movement than the latter, and less familiar to the inexperienced observer. They inhabit fresh-waters (a few only are marine) and the mud or slime of fresh-water pools of brackish estuaries and of sluggish streams, whilst the Lumbriciformia are large worms with opaque, thick body-wall, which forcibly burrow in loose, air-holding earth, and have,

as a rule, a close resemblance to our common earth-worm in shape, colour, and habits. The larger Sænuridiformia, such as *Lumbriculus* and *Phreoryctes*, have the brown-red colouring of earth-worms, and, although differing in shape and movement from Lumbriciformia, are liable to be mistaken for young earth-worms when appearing, as they sometimes do in great number, in the reservoirs and mains of water-supplying companies.

The Lumbriciformia comprise a great number of genera distinguished by peculiarities of their reproductive apparatus, their renal organs (nephridia), and the gizzards and other parts of the digestive canal. They have as a rule a specially rich supply of blood-vessels to the integument which serves as a respiratory organ. This special blood supply is not present in the Sænuridiformia, which have, however, well-developed, deeper-lying vascular trunks holding hæmoglobinous fluid.

The word "earth-worm" is often applied to the whole group of Lumbriciformia, which are contrasted as "Terricola" with the Sænuridiformia, for which the term "Limicola," or "mud-dwellers," is used. There are good reasons, however, for limiting the word "earth-worm" to the common English earth-worm, *Lumbricus terrestris*, and the few closely allied species of *Lumbricus*. Those reasons come to our notice when we are considering the possible drowning of the common earth-worm and the respiratory conditions connected with that mishap. They are, first, that a whole family of Sænuridiform worms is known—the Enchytræidæ—which are *not* water-dwellers or mud-dwellers (Limicola), but live in humus and amongst dead leaves, and are, in fact, just as much "Terricola" as are the commoner Lumbriciformia. And, secondly, there are at least two genera classed with the Lumbriciformia which live, *not* in the earth, but in open water. One of these is the *Criodrilus lacuum* (occasionally found in England, but common in Central Europe), which has the appearance, size, and inner structure of the Lumbriciformia—and, indeed, is a close ally of *Lumbricus*; and the other is the *Alma nilotica* or *Digitibranchus niloticus*, which not only lives entirely in the water, but is also provided with a series of filamentous, naked branchiæ containing a blood-red vascular fluid. I am not able to state whether *Criodrilus* has or has not a tegumentary blood supply. It has not, I think, been studied from this point of view. There is no full account (so far as I can ascertain) of the structure of *Alma nilotica*, nor have illustrations of its anatomy been published, though systematists have given brief accounts of this and allied species.

I think, then, that it is clear that we must not extend the implications of the word "earth-worm" when discussing details of structure and physiological adaptation beyond the particular species which has been the actual subject of study. In writing here of the drowning of earth-worms I have intended my statements to apply only to the common British earth-worms called *Lumbricus terrestris*. Probably they are true of many other Lumbriciformia, but that is only a supposition which must be tested and must not be held as fact until proved by further examination to be so.

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P.S.—I find that Vejdowski has described a rich network of capillary blood-vessels in the integument of *Criodrilus* (a Lumbriciform), and that in *Limnodrilus Hoffmeisteri* (a Sænuridiform) he has found capillaries in small groups of four, ending blindly in the epidermic cell-layer. Such capillaries in the integument are, he says, absent, as a rule, from all Oligochæta except the Lumbriciformia.

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