# NOTES ON THE CIRCULATORY SYSTEM IN BURMESE SPECIES OF *DRAWIDA* (OLIGOCHAETA).

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Very little work has hitherto been done upon the circulatory system of Moniligastrid earthworms; the only extended account being that by Bourne published as long ago as 1894. Bourne's species, *Drawida grandis*, is known only from the type locality, Naduvatam in the Nilgiri Hills of South India, and is especially interesting because of its large size; it is distinguished from the majority of species of *Drawida* by its "muscular" prostates.

These notes are based primarily on a study of *Drawida longatria* Gates 1925, probably the most common and widely distributed Burmese Moniligastrid. The only specimens available for study were those which had been killed and preserved for taxonomic purposes according to the simple procedure used in this laboratory.

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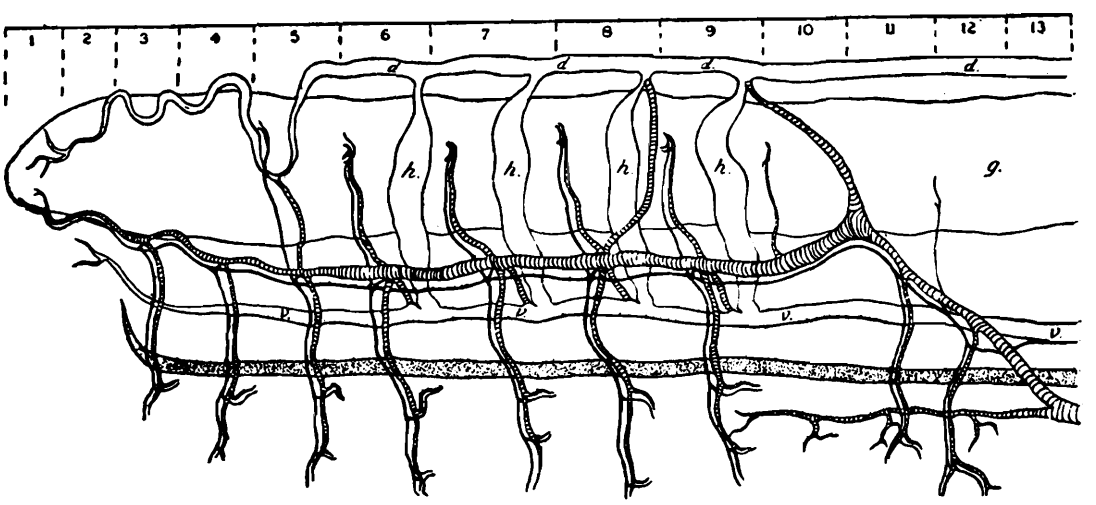
## THE CIRCULATORY SYSTEM IN *Drawida longatria*.

The dorsal blood vessel is single throughout and attached to the gut by a transparent, vertically placed, longitudinal mesentery. In the first




TEXT-FIG. 1.—Diagrammatic side view of the circulatory system in the first thirteen segments of *Drawida longatria*.

The nerve cord is stippled; the extra-oesophageal and its branches, as well as the subneural cross-striped. The longitudinal trunk just under the extra-oesophageal and its branches are solid black. Dorsal and ventral vessels and the hearts are left plain.

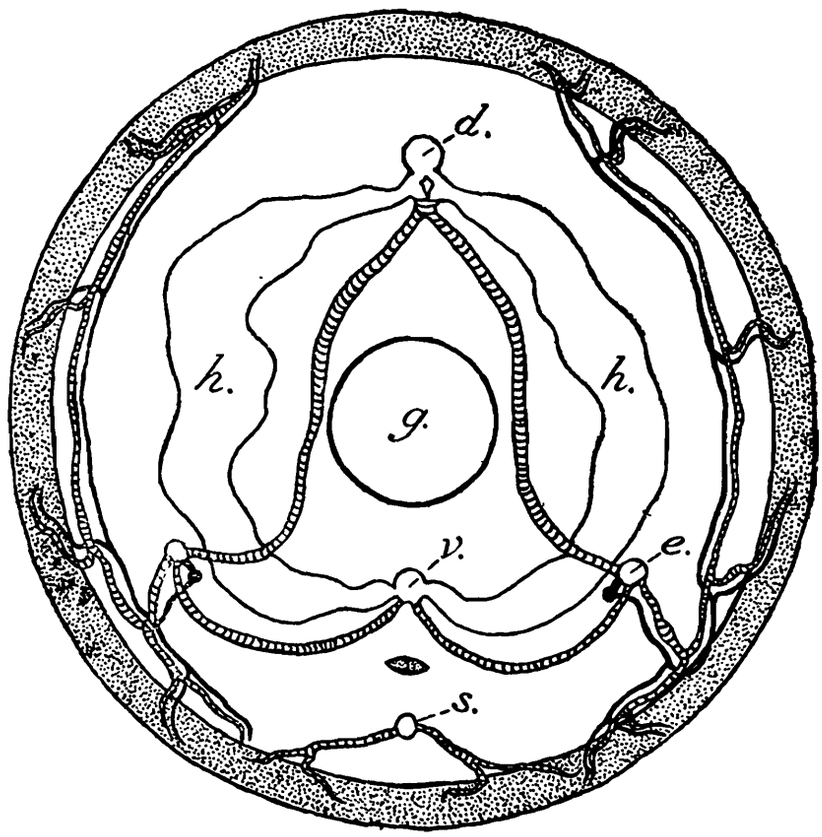
*d.* Dorsal vessel; *g.* Gut; *h.* Heart; *v.* Ventral vessel.

five segments the vessel is looped as the length in this region is greater than the combined lengths of the segments, finally terminating in a network of capillaries on the dorsal face of the gut. Posteriorly the

vessel is continued into the last segment where it bifurcates, the branches passing ventrally around the gut.

The ventral vessel lies immediately under the gut and is continued posteriorly into the last segment. Anteriorly the vessel bifurcates, the branches passing dorsally along the circumpharyngeal nervous commissures.

The subneural vessel lies under the nerve cord and is visible posteriorly into the last third of the body where it tapers to a fine thread and disappears. In xii or xiii it branches into two large trunks which for the present may be referred to as the extra-oesophageals though they differ from the vessels to which that name has been given in other earthworms. These trunks are lateral to the hearts and at a level slightly above that




TEXT-FIG. 2.—Diagrammatic sketch of the transverse section of *Drawida longatria* through posterior region of segment viii, as viewed from behind.

The nerve oord is stippled; the extra-oesophageal and its branches, as well as the subneural cross-striped. The longitudinal trunk just under the extra-oesophageal and its branches are solid black. Vessels and the hearts are left plain.

*d.* Dorsal vessel; *e.* Extra-oesophageal vessel; *g.* Gut; *h.* Heart; *s.* Subneural vessel; *v.* Ventral vessel.

of the ventral vessel, branching into a capillary network in segment i. The subneural itself may terminate by branching into the two extra-oesophageal trunks or may be continued anteriorly into vi, though usually it disappears in x.

A longitudinal vessel is visible in the mesentery between the dorsal vessel and the gut in segment xiii to the last gizzard segment, a connection at either end with other vessels and structures has not been established but both anteriorly and posteriorly it appears to bifurcate and pass on to the gut.

A slender longitudinal trunk is present on each side immediately ventral to the extra-oesophageals, sending off branches to the septa and body wall along with branches from the extra-oesophageals. The trunks are first visible on the lateral face of the gut in the region of segment i and disappear posteriorly in xii or xiii. In three worms the trunks were traced to or onto the ventral vessel.

In the posterior part of each intestinal segment a branch from the ventral blood vessel passes on each side at right angles to the ventral trunk to the body wall where it breaks up into a capillary network after giving off branches to the anterior face of the septum. In the gizzard segments this vessel appears to be continued dorsally either to the dorsal trunk or to the longitudinal, mesenterial vessel. Just in front of the septum in each intestinal segment is a pair of commissures connecting the subneural and dorsal trunks. These commissures are close to the peripheral branches of the ventral trunk and connected with them by slender tubes.

In each of segments vi-ix there is a pair of hearts (50 specimens). These are thick-walled vessels opening into the ventral vessel by somewhat bulbous swellings. Dorsally the hearts of a segment unite and then open into the dorsal vessel by a very short, thin-walled, median tube. In four specimens only a pair of slender commissures connects the extra-oesophageals with the dorsal vessel in an anterior part of segment v, the dorsal vessel looping down almost to the level of the extra-oesophageals so that the actual connection between the two is short.

A pair of commissures in each specimen (50) is present on the anterior face of 8/9 in viii. These commissures open into the hearts of that segment slightly ventral to the connection of the latter with the dorsal vessel. Ventrally the commissures open into the extra-oesophageals in the posterior half of the segment.

## THE CIRCULATORY SYSTEM IN OTHER BURMESE SPECIES OF *Drawida*.

Specimens belonging to 18 Burmese species of *Drawida* have been examined, a number of specimens of each species. In each species with two exceptions the arrangement of the blood vessels is consistently the same as in *D. longatria*. In *D. caerulea* Gates 1926 there are no commissures in viii between the extra-oesophageals and the dorsal trunk, but instead a pair of similar commissures is present in ix on the posterior face of 8/9. In *D. rangoonensis* Gates 1925, the pair of commissures appears to be in the septum 8/9 itself.

## DISCUSSION.

As a result of the work done on the Burmese species of *Drawida* one important fact has been established, that is that the extra-oesophageals are always lateral to the hearts. In one other Burmese Moniligastrid, *Desmogaster doriae* Rosa 1890, the same arrangement has been noted (Rosa 1890, pl. xii, fig. 11). In all other earthworms in which the position of the extra-oesophageals has been recorded the location is median to the hearts. Secondly, extra-oesophageals are not attached to or on the gut except in the anteriormost segments where they break

up into a capillary network on the lateral face of the pharynx. In other earthworms these vessels are on the gut at least through some portion of their length. Further a supra-oesophageal vessel is always lacking nor have suboesophageal or extra-neural trunks been found. Finally the hearts are all and always lateral as in the Lumbricidae and Microdrili rather than latero-oesophageal, at least in part, as in the Megascolecidae.

Bourne does not mention in the text the position of the extra-oesophageals (or latero-longitudinals as he calls them) in *D. grandis*[1] with reference to the hearts but in his diagrams (pl. xxvi, figs. 32 and 33) he clearly indicates their position as being median. This may be an error in drawing or observation but as *grandis* is aberrant in other respects this may be yet another peculiarity of the species. Yet another possibility is that Indian Moniligastrids are distinguished from the Burmese forms by a median location of the extra-oesophageals.

Other minor differences from *D. grandis* are the presence of a longitudinal mesenterial vessel above the gut (which may have been overlooked by Bourne) and the continuation of the subneural anterior to the origin of the extra-oesophageals. In Burmese species there are short commissures connecting the extra-oesophageals, the longitudinal trunks (those beneath the extra-oesophageals) and the ventral vessel either directly or indirectly with each other. No connections of this type have been recorded by Bourne.

## REFERENCES.

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[1] Through the kindness of Dr. C. C. A. Monro of the British Museum, Miss Chapman, while on leave, was able to examine a specimen of Bourne's *D. grandis*. She writes that "The extra-oesophageals (latero-longitudinals of Bourne) are definitely lateral to the hearts as in Burmese species of *Drawida*." The lateral position of the extra-oesophageal trunks, therefore, seems to be characteristic of the family Moniligastridae.