

On the
Systematic Position and Relationships
of the
Temnocephaleae.

By
William A. Haswell,
Professor of the University Sydney.

When first discovered *Temnocephala* was regarded by Gay as a Hirudinean, and the same view was adopted by Blanchard,¹⁾ and by Moquin-Tandon.²⁾ Philippi³⁾ regarded its nearest relative as being *Malacobdella*. Semper⁴⁾ was the first to set it down as an ectoparasitic Trematode, and in this he was followed by myself⁵⁾ and by Weber.⁶⁾ I proposed that it should be regarded as constituting a distinct family of the *Monogenea*, more nearly related to the *Tristomidae* than to any of the others. In this conclusion Weber fully concurred.

In 1888 Monticelli published a general account of the Trematodes under the title "Saggio di una morfologia dei Trematodi" in which he assents to my previously expressed view of the relationships of *Temnocephala*, and proposes to divide the Monogenetic Trematodes into three sections according to the number and disposition of the suckers, viz. the Tristomeae, the Temnocephaleae and the Polystomeae.

M. Braun (Braun's "Klassen u. Ordnungen des Thierreichs", 'Vermes') also regards the *Temnocephaleae* as a distinct family, but does not recognise any close relationship with the Tristomidae. To quote his words (p. 522) "Demnach betrachte ich *Temnocephala* nicht — wie Monticelli — als einen Seitenzweig der Tristomeen, sondern als einen selbständigen, früh abgezweigten Ast, der mit den heute lebenden monogenetischen Trematoden weniger nahe Beziehungen besitzt, als diese unter einander." But Braun is not fully satisfied that the position of *Temnocephala* as a Trematode is completely established "Temnocephala bietet allerdings eine Reihe von Besonderheiten dar, und die Frage ist trotz der Arbeiten von Haswell und Weber gerechtfertigt, ob Temnocephala ein Trematode ist" (p. 520). Further on (p. 521), after quoting von Graff's definition of the Turbellaria he remarks "Wenn man von der letzten Bemerkung über die Lebensweise, die keinen systematischen Werth besitzt, absieht, so bleibt als einziger Unterschied zwischen Turbellarien und Trematoden das für erstere charakteristische Flimmerepithel der Haut mit Stäbchen oder Nesselorganen bestehen."

¹⁾ Gay's Zoology of Chilé, II. p. 51.

²⁾ Monographie des Hirudinés, p. 300.

³⁾ Arch. f. Naturgeschichte, XXXVI. 1870, p. 35.

⁴⁾ Zeitschr. f. wiss. Zoologie. XXII, 1872, p. 307.

⁵⁾ Quart. Journ. Micro. Sci. Vol. XXVIII. (1888).

⁶⁾ Zool. Ergebnisse einer Reise etc. p. 25. (1889).

My renewed study of *Temnocephala* having resulted in the discovery of cilia on the surface of certain of the species, and having led to the conclusion that "Stäbchen" exactly, like those of Rhabdocoele Turbellarians are present in abundance, the line of demarcation seems still harder to draw.

The integument of *Temnocephala* is quite exceptional if we are to regard that genus as an ectoparasitic Trematode. A complete distinct epithelial layer does not occur in other genera, though in some (*Nitschia* and *Epibdella*) as observed by Braun,¹⁾ such a layer is distinguishable on some parts of the surface — but without cuticle or basement-membrane. In the others the outermost layer of the body seems rather to correspond to the basement-membrane integument of *Temnocephala* than to a modified epidermis; it is homogeneous, does not readily become stained, and seems to be of a resistant character. On the other hand in this regard *Temnocephala* approaches very near to the Rhabdocoele Turbellaria; the epidermal layer is of similar character in the two groups, and the presence of cilia in two of the species of *Temnocephala* makes the resemblance very close. The basement-membrane is absent in the *Rhabdocoela*; but it would not appear to be present in all the species of *Temnocephala* (see Weber's account of *T. Semperi* quoted above). Tactile cones similar to those of the integument of *Temnocephala* have only been found elsewhere, so far as I am aware, in a Trematode (*Sphyrnura*²⁾); but the delicate motionless hairs that occur among the vibratil cilia in the Rhabdocoeles are of a similar nature.

A striking point of resemblance between the *Temnocephaleae* and the *Rhabdocoela* is the presence in both of the system of unicellular integumentary glands forming rhabdites (Stäbchen). The arrangement of their ducts in the former as they run forwards in the anterior region of the body into broad strands or "Stäbchenstrassen" precisely corresponds to what we observe in many Rhabdocoeles; and nothing of the kind appears to occur among the Trematodes.

The structure of the pharynx is similar to what obtains in some of the Rhabdocoeles such as *Mesostomum*; but, on the other hand, it appears to be equally near to that of the corresponding organ in *Polystomum*, *Sphyrnura*, and certain other *Monogenaca*. The intestine and its epithelium closely resemble those of a Rhabdocoele — the only difference of importance being the presence of constructions in most species of *Temnocephala*.

¹⁾ Tom. cit. p. 422.

²⁾ Wright and Macallum, *Sphyrnura Osleri*, a contribution to American Helminthology, Journal of Morphology, Vol. I. (1887.)

The excretory system is, so far as our knowledge extends, quite peculiar. It more nearly resembles that of the ectoparasitic Trematodes than that of the Rhabdocoeles — the contractil, pulsating terminal sac being absent in the latter group and almost universally present in the former.

In its nervous system *Temnocephala* exhibits one of the highest types of development among Platyhelminthes, with its comparatively large brain, the rich development of nerves running forwards, the three pairs of posterior trunks, and the highly developed subcutaneous nerve-plexus. But in these respects it does not stand quite alone. In *Tristomum molae* as described by Lang¹⁾ all these features recur, and, but for the less development of the anterior nerves and certain differences in the relations of the subcutaneous nerve-plexus (which in *Tristomum* is apparently equally contributed to by all three pairs of trunks), there is a very close correspondence between the two. Though a subcutaneous nerve-plexus is present in *Tricladidae* and *Polycladidae*, nothing of the kind has been noticed in the *Rhabdocoela*, and there would appear never to be more than one pair of nerve-trunks running backwards from the ganglion in that group. The eyes of *Temnocephala* can be exactly matched among the *Rhabdocoela*, and on the other hand, are, in all essential respects, similar to those of *Tristomum*.

In its reproductive apparatus *Temnocephala* appears to me to find closer alliances among the Rhabdocoeles than among the ectoparasitic Trematodes: and of the former group various *Vorticidae* as described by v. Graff and others approach very near to it in the general arrangement of the parts, as well as in the special character of the cirrus. A bursa copulatrix is absent in *Temnocephala*, but the muscular “vagina” of *T. novae-zelandiae*, though leading directly to the uterus and oviduct, may represent it; and the teeth in its interior bear a striking resemblance to those in the bursa copulatrix of some of the Rhabdocoeles such as *Proxenetes flabellifer*.²⁾ But spines or teeth occur round the mouth of the opening of the oviduct in *Axine*, *Microcotyle* and others.

The testes resemble the compact type of these glands occurring among the Rhabdocoela; but are also nearly approached in form by those of some ectoparasitic Trematodes, though there are no other members of the latter group that have four. The ovary has in many Rhabdocoeles the same form and relations and sometimes

¹⁾ Untersuchungen zur vergleichenden Anatomie u. Histologie des Nervensystems der Platyelminthen. Mittheil. a. d. Zool. Station zu Neapel. II. Bd. p. 28.

²⁾ von Graff, Monographie der Turbellarien. Taf. VIII. fig. 16.

internal structure as in *Temnocephala*; but the same holds good of *Sphyranura* and perhaps also of some other *Monogenaea*.

Very close is the resemblance between *Temnocephala* and the *Rhabdocoela* in the system of accessory glands secreting rounded granules connected with the male reproductive apparatus. Von Graff's account of these structures as they occur in the *Rhabdocoels* applies equally well, word for word, to *Temnocephala* — the only difference of consequence being in the much greater length of the ducts in the latter case. The so-called "prostate-glands" of some *Monogenaea* are evidently the same structures less specially developed.

Stalked eggs similar to those of *Temnocephala* occur among the *Rhabdocoels* — the "stalk" in some of the latter, as in some of the species of the former, not always serving for attachment. But similar eggs are met with also among the *Monogenaea*.

Sufficient data are wanting for a comparison of the embryological history in the various groups under discussion. What is known does not seem to tell more in one direction than in another. The embryo of *Temnocephala* undergoes direct development, and becomes fully formed while still within the egg — the reproductive apparatus alone remaining undeveloped. This direct development and absence of metamorphosis it shares equally with the monogenetic Trematodes and with the *Rhabdocoels*.

On the whole, on reviewing the evidence, I am inclined to think that the Trematode affinities of *Temnocephala* preponderate over the Turbellarian. It presents an assemblage of characters which distinguish it very broadly from any individual member of the former class; but perhaps it has rather more important points of resemblance in the various features of its structure with, now one, now another family of Trematodes than with the *Rhabdocoels*. The large ventral sucker, the excretory sacs, and the nervous system may be set down as decidedly Trematode and not *Rhabdocoele* in character. The preponderance, however, if it occurs, is only slight, and I should see little reason for finding fault with anyone who regarded *Temnocephala* as an aberrant *Rhabdocoele* specially modified in accordance with a peculiar mode of life.

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Autor(en)/Author(s): Haswell William A.

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