

cally on *Lithoglyphus* of Europe. While the latter belongs, on the basis of comparative anatomy, to the Hydrobiidae, the former was considered to belong to the Pomatiopsidae: Triculinae by Davis (1979), but anatomical proof was lacking. Further attention was drawn to the genus *Lithoglyphopsis* when Temcharoen (1971) classified the snail host transmitting *Schistosoma mekongi* in the Mekong River as a species of *Lithoglyphopsis*.

In this paper I present anatomical data for toponotypical *Lithoglyphopsis modesta* that serve to classify the species in the Triculinae, tribe Triculini. The Mekong River snail is assigned to (and is the type species for) the genus *Neotricula* of the Triculinae, tribe Pachydrobiini. A phylogenetic analysis is given showing the coevolved relationship of all included genera and relevant species of *Schistosoma* to the transmission of various species of *Schistosoma*.



A COMPARISON OF METHODS OF SHELL DESCRIPTION, APPLIED TO SCHISTOSOME VECTOR SPECIES IN THE GENERA *BULINUS* AND *BIOMPHALARIA*

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What sort of measurements should be made on a gastropod shell? In this work we compare the usefulness of several sets of measurements, taken from many species in two genera of medical importance, *Bulinus* and *Biomphalaria*. Measurements have been made from x-ray photographs; these let us measure the relative positions of consecutive whorls and how shape changes through ontogeny.

Character Set 1 describes shell shape and size in the spirit of Raup (1966, Geometric analysis of shell coiling: general problems. *Journal of Paleontology*, 40: 1178-1190). Thus breadths and heights are measured relative to the direction of the coiling axis. Character Set 2 attempts to be a more meaningful representation of the actual developmental rules used in the construction of the shell. For instance, one character quantifies where a new whorl attaches to the surface of the preceding whorl (Hutchinson, 1989, *Journal of Theoretical Biology*, 140: 431-444); dimensions of the aperture are measured relative to its own orientation. Character Set 3 ignores how the shell was constructed but represents aspects of shape likely to be of direct selective significance. For instance the depth of the suture may affect the ability of a predator to grip the shell, and the height of the spire relates to habitat use (Heller, 1987, *Biological Journal of the Linnean Society*, 32: 257-272.). For this character set we use the longest and narrowest dimensions of the shell rather than measure parallel to a particular direction.

In choosing characters for these three character sets, we have tried to ensure that each region of the shell described in one character set is also represented in the other sets. In addition we have constructed further character sets as controls, in which landmarks used in Sets 1-3 have been paired off at random and the distances between members of the pair calculated.

Characters of direct selective value will usually be the complex products of characters under more direct developmental control. For instance shell height is a modified sum of several whorl heights, each determined at a different stage in development. Similarly, to alter suture depth the snail can either alter the shape of the preceding whorl, or of the whorl added later, or the position of attachment of the later whorl onto the earlier. Thus it is a widespread dilemma whether to use characters likely to be directly selected, or characters that development might plausibly alter directly and independently of other such characters; we should not expect the same character set to do both. On the other hand it is not always possible to say that a character is purely "developmental" in significance or purely "selective." For instance, expansion rate is probably under direct developmental control, but it also directly determines the size of the aperture relative to volume, which is of obvious selective significance.

Raup's measurements and the control character sets describe morphology in ways neither directly reflecting selection nor developmental processes. For some purposes it may be best to use totally uninterpretable characters each of which combines several dimensions of direct selective or developmental significance; perhaps the more complex the character, the more likely we are to detect a change of shape. In practice what may matter even more is a low measurement error.

The multivariate analysis of these character sets is still continuing. We are concerned to test their usefulness both in detecting differences between known species (using discriminant-function analysis) and in quantifying how different the species are (using cluster analysis). Does distance apart in "developmental" space (Character Set 2) agree well with distance apart in "ecological" space (Character Set 3)? We will go on to compare these distances with what is known of the species' phylogenies and ecologies.



FINDING OF *ECHINOSTOMA REVOLUTUM* (SKRJABIN 1964) CERCARIA IN
STAGNICOLA ATTENUATA (SAY 1829), (GASTROPODA, LYMNAEIDAE)
IN THE LERMA MARSHES, STATE OF MEXICO, MEXICO

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The study was carried out in Mexico between 1973 and 1976. Three species of gastropods from the Lerma Marshes, State of Mexico (37 miles northwest of Mexico City), were analyzed and nine cercariae were found. During the study it was noteworthy that *Echinostoma revolutum* cercariae were found in the gastropod *Stagnicola attenuata*. The larvae were completely identified, described and drawn *in vivo*. The larvae were compared with other larvae described previously and all the structures were corroborated with *E. revolutum*, a well known parasite of migratory birds of North America.



DESCRIPTION OF TWO CERCARIAE BELONGING TO THE FAMILY STRIGEIDAE
(RAILLIET 1919) IN GASTROPOD MOLLUSKS FROM THE
LERMA MARSHES, STATE OF MEXICO

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The study was carried out in Mexico during the years 1973 to 1976 in the Lerma Marshes, State of Mexico (37 miles northwest of Mexico City). Nine different cercariae were identified, and of those it was noteworthy that two of them belonging to the family Strigeidae were found in two gastropod mollusks: *Physa mexicana* and *Stagnicola attenuata*. The trematode larvae were fully identified, drawn and microphotographed. The two species of furcocerca cercariae belong to the family Strigeidae, which are bird parasites.



KARYOTYPE STUDIES IN TWO SPECIES OF *LYMNAEA* (MOLLUSCA, PULMONATA)

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Although many species of the freshwater pulmonate snail family Lymnaeidae have been studied cytogenetically, research on chromosome evolution in specific genera or species are still scarce. Several lymnaeid species include hosts involved in transmission of human dis-