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Ultrastructure of the Spermatozoon of the Internal Self-Fertilizing Hermaphroditic Fish *Rivulus marmoratus*

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The spermatozoon ultrastructure of the internal self-fertilizing hermaphroditic fish *Rivulus marmoratus* has been studied by electron microscopy. The mature spermatozoon is composed of a spherical head, a short enlarged midpiece, and a tail. The head without acrosome, about 1.8 $\mu$ m in diameter, has homogeneously electron-dense nucleus with a bell shaped axial nuclear fossa, the length of which is about one-thirds of the nuclear diameter. The nuclear fossa is entirely occupied by the proximal centriole whereas the distal centriole is located on the base of the head. The midpiece contains six to seven spherical large mitochondria, and the mitochondrial collar encircles the base of the flagellum which are completely separated from mitochondrial collar by the narrow cytoplasmic canal. The axoneme of the tail has the classic 9+2 formula. A rather short flagellum of about 26 $\mu$ m in length has two side fins. It is concluded that in spite of unique mode of reproduction of *Rivulus marmoratus*, the *Rivulus* spermatozoon is of a primitive type and similar to that of external fertilizing fish. This implicates that the internal self-fertilization of this species may be evolved very recently from external fertilization of gonochoric relatives.

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A Comparative Study on the Ultrastructures of the Egg Envelope in Fertilized Eggs of Fishes, Cichlidae, Three Species

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The structures of the egg envelope in fertilized eggs of three species of cichlidae, golden severum (*Cichlasoma severum* var.), convic cichlid (*Cichlasoma nigrofasciatum*) and discus (*Symphysodon aequifasciatus*) were investigated using light and electron microscopes. The fertilized eggs in all species were non-transparent, ellipsoidal, adhesive and non-floted type, and there were oil droplets in the yolk sac and no adhesive filament. The egg envelopes have a single micropyle resembling the pathway of sperm in the area of the animal pole. An outer surface of egg envelope in golden severum was covered by a reticular layer, that of discus was covered by a branched reticular layer, and that of convic cichlid was covered by an amorphous reticular layer. Egg envelopes of fertilized eggs consisted of two distinct layers; an adhesive outer layer and an inner layer, consisted of lamellae alternating with interlamellae of lower electron density, in all species; an inner layer of golden severum was 15~17 layers, that of discus was 18~19 layers, and that of convic cichlid was 14~16 layers. In conclusion, the structure of the egg envelope seems to be an indication of the systematic statue of the species.