

mass. There is an extensive degeneration of eggs after they have reached the maximum size.

(3) The embryo remains within the ovarian follicle until the small yolk mass is almost absorbed, in the meantime developing a group of nutritional filaments. A yolk sac also develops far past the limits of the yolk mass. The ovary develops a system of inter-follicular canals and clefts.

(4) The embryo hatches and is left by a withdrawal of the ovary in the intra-ovarian space. The nutritional filaments develop into long finger shaped processes which are attached to the embryo at the proctodoeum. In at least four genera a wide space in the sub-mucosa of the embryonic gut extends out into the nutritional processes as far as the distal ends. The processes become liberally supplied with tissue spaces, sinuses and small blood vessels. While the embryos of all genera possess the nutritional processes there are structural differences that are constant in each genus.

(5) The embryo increases many times in volume while lying in the intra-ovarian space and after absorbing the small yolk mass.

(6) The embryo is born in an advanced stage with the gonads differentiated into recognizable ovaries and spermaries. The nutritional processes are still at their maximum point of development at birth. They are either broken off or absorbed within a few hours.

Reproduction in the lowland type of killifish is classified as simple ovo-viviparity, the egg, and later the embryo being retained in the ovarian follicle up to the time of birth. Reproduction in the highland type of top minnow is a two-phase process. The first phase, extending from fertilization to the point of the extrusion of the embryo from the follicle into the ovisac is an ovo-viviparity comparable to but shorter than the entire process in the lowland type. The second phase is a superimposed and genuine viviparity which is not comparable with any stage in the reproduction of the lowland type. The reproduction in the highland top minnows is therefore classified as ovo-viviparity with a superimposed viviparity.

The highland type of top minnows apparently arose from an ancestor much like the lowland type after viviparity had been established in the latter. The yolk sac developed in the latter type beyond the limits of the yolk mass is testimony that the ancestral type possessed a large yolk sac. The evolution of the reproductive peculiarities in the highland type from the condition which existed in its ancestral type would involve the following changes:

(1) Changes in the ovary to prohibit the full development of the yolk or to produce degeneration in the egg before it reached its full size.

(2) Earlier hatching of the egg.

(3) Retention of the embryo for a longer period in the intra-ovarian space.

(4) Development by the embryo of processes for absorbing food and oxygen from maternal ovary.

(5) Extensive changes in the somatic portion of the ovary, especially in vascularity, to furnish nourishment for the embryos.

(6) Interruption of the regular course of the germ cell cycle within the ovary due to the diversion of nutrition from the developing germ cells to the growing embryos.

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