

Embryogenesis in the Japanese Medaka, *Oryzias latipes*

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The Japanese Medaka, *Oryzias latipes*, is a freshwater teleost belonging to the family Cyprinodontidae. The Medaka is a widely used model for observation of the stages of teleost development. The cytoplasm of the unfertilized telolecithal egg surrounds yolk vesicles. Sperm enters the egg through the micropyle, a small opening in the chorion. Upon fertilization, yolk and cytoplasm are separated. The cytoplasm migrates to the animal pole where discoidal meroblastic cleavage occurs. At midblastula, cells of the blastoderm become mobile and spread over the yolk in the process known as epiboly. Gastrulation begins dorsally with involution of deep blastoderm cells to form an outer epiblast and inner hypoblast. During convergence, cells move to the dorsal side of the egg to form a thickening known as the embryonic shield. Extension establishes the anterior-posterior body axis by means of elongation towards the animal pole. Following gastrulation, the Medaka undergoes neurulation and organogenesis.

Fertilized Medaka eggs were viewed under light microscopy through the transparent chorion from approximately six hours post-fertilization until hatching eleven days later. Several major developmental stages were observed. The first observation was of the early blastula, which was located at the animal pole. At approximately 13 hours post-fertilization, epiboly began, and involution marked the start of gastrulation. At 23 hours, neurulation was observed as the keel of the central nervous system appeared in the midline of the embryonic shield. During neurulation, division of the rudimentary brain was also observed. At 29 hours, the optic vesicle, which later gives rise to the optic cup, was visible as an extension of the diencephalon. The optic cup and lens vesicle were observed at 40 hours. Otic vesicles, which form the structures of the inner ear, were seen as extensions of the rhombencephalon. At 54 hours, the embryo began to twitch and colorless blood flowed through vessels. By 84 hours, the retina was pigmented, and somites and the pectoral fin were developed. The embryo was observed until hatching, approximately eleven days post-fertilization. It was then fixed for scanning electron microscopy. Observations provided not only a model of teleost development, but of early stages common in the development of all vertebrates.