

理学部生命科学セミナー

# Choriogenesis and fertilization in fish

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(カリフォルニア大学デービス校)

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1号館13番教室

\* 本セミナーは理学特論 II の一環として開講します。

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(生物学科 渡邊)

## **Choriogenesis and fertilization in fish**

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Fertilization consists of a sequence of events which results in the fusion of the pronucleus of the sperm with that of the egg and the initiation of development. These events include the sperm-egg interaction, egg surface changes including the prevention of polyspermy and the activation of the egg. The mechanisms of fertilization have been conserved in animals during evolution, although, of course, each species has evolved different mechanisms adapted to the environment surrounding the fertilized egg, thus optimizing the survival of the embryos and offspring. Compared with other species, mammals are able to give birth to a small number of offspring at one time because their guardian system for embryonic growth and parental care, including lactation, provides increased safety and augments the continued development of the offspring during the most vulnerable stages.

Under natural conditions, fertilization must be completed between one maternal gamete (oocyte, egg) vs. one paternal gamete (sperm). It is fatal if more than one sperm fuses with the oocyte; when this happens, most embryos die at an early stage. For monospermic eggs, mechanisms to prevent supernumerary sperm penetration into the oocytes, called, “the block to polyspermy or polyspermy block,” must exist, and yet, to date, a large part of these mechanisms remains unclear.

In mammals, the upper reaches of the female's oviduct called, “the infundibulum,” is the site of fertilization, and in order for the successful implantation and embryonic development, a special site called “the uterus” has evolved where the subsequent development of the fetus takes place and where nutritional support to the fetus is supplied. After implantation in the uterus, the mammalian fetus develops a respiratory, excretory and nutritive supply line directly to the mother, called the placenta. Another special organ in mammals, is the mammary gland which allows the newborn to feed on mammary secretions.

In contrast to mammals, oviparous fish have developed a system to spawn and fertilize a huge number of eggs at the same time. In such fishes, the process of fertilization may have to be accomplished very quickly after the release of each gamete i.e., sperm ejaculation and egg spawning, to enable the sperm-egg interaction, the fusion of the gamete nuclei and the establishment of a block to polyspermy. Unlike mammals, the eggs of most bony fishes (Euteleostomi) have a unique structure, the micropyle, on the surface of the egg envelope which permits only a single sperm to penetrate into the oocyte, leading to the direct attachment of sperm to the plasma membrane of the egg.

In oviparous fish, before spawning, during oogenesis in the female, the vitellogenin and choriogenin are synthesized in the liver under the influence of estrogen and accumulate in the oocyte as the yolk to serve as nutrition for the embryo, and in the egg envelope (chorion) to protect the embryo from the chemical, physical and biological insults in the environment.

My class and seminar focus on discussing the current understanding of the major strategies employed by fishes during choriogenesis and fertilization, particularly on the morphological, physiological and molecular biological features of the gametic devices for external fertilization which occurs in most teleosts.