Laboratory of Developmental Biology

Graduate School of Science

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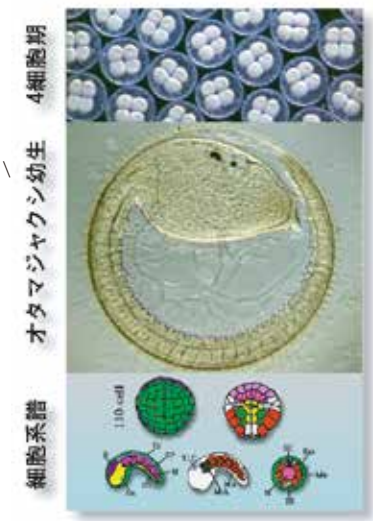
We all originated from fertilized eggs of 100 micron. Have you ever wondered how this is possible? In our laboratory, we use embryonic micromanipulation, genetic engineering, microscopic imaging, and developmental genetics to address the question of how the body is formed from the egg.

Cellular and molecular analysis of ascidian early embryogenesis

During development, the number of cells does not only increase, but also cells with a wide variety of functions are produced. For example, epidermis, muscle, nerve, and blood cells are produced. All of these cells originate from the fertilized egg. How does an egg divide and how do certain cells become muscles while others become nerves? In other words, the projects in our laboratory is to elucidate the mechanism that determines the developmental fate of embryonic cells.

Ascidians, which are animals that are closely related to vertebrates, are used as experimental materials. Fertilized eggs of ascidians develop in 35 hours into tadpoles like the one on the right figures. The development of the ascidian has already been described in detail, and it is possible to predict exactly which embryonic cells produce which parts of the the tadpole. The originality of our research lies in the fact that we are analyzing various events that occur in an entire animal, the ascidian, and attempting to understand how developmental cell fates are determined. Ascidian tadpole larvae have a simple structure and consist of a small number of cells. This suggests that the mechanisms that determine developmental fate during embryogenesis could be unveiled tissue by tissue and for all tissue types. Using a simple but prototype of vertebrates, we have been elucidated the cell fate-determining mechanisms for most tissues. This is a significant milestone in the advancement of embryology.



(Top) Ascidian four-cell stage (3 hours after fertilization).
(M) Tadpole larvae just before hatching.
(35 hours after fertilization).
(Bottom) Cell lineages and a fate map.
It shows which cells of the early embryo will become which parts in the tadpole.

Developmental Genetics of the Larvaceans

The laboratory culture of larvaceans has greatly expanded the possibilities for research using this animal. The larvaceans is considered to be an ideal experimental animal for genetic analysis. This is due to a short life cycle of only 5 days, a compact genome with short intergenic regions, and no whole genome duplication. In this respect, we believe that larvaceans will be a promising experimental animal in the future. The creation and analysis of transgenic lines and mutants is a powerful research tools for analyzing mechanisms of embryogenesis. We started research to realize such technologies in the larvaceans.

The life of larvaceans.
After fertilization, they start to lay eggs in 5 days.

References (Review)

Nishida, H. Specification of embryonic axis and mosaic development in ascidians. *Developmental Dynamics* (2005) **233**, 1177-1193.

Nishida, H. Development of the appendicularian Oikopleura dioica: culture, genome, and cell lineages. *Dev. Growth Differ.* (2008) **50,** S239-S256.

Nishida, H. and Sawada, K. Mesoderm patterning during ascidian embryogenesis. *Cell Engineering* (2002) vol.21, no.1 pp.98-105

Nishida, Hiroki I named the gene "Macho-1" *Experimental Medicine* (2005) vol.23, no.3 pp.420-422

This lab will not accept students in 2023

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