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Meet a *Sci*-Star: Hiroki Nishida

Hiroki Nishida is a professor and biological researcher studying cellular and molecular mechanisms of differentiation and morphogenesis during ascidian embryogenesis. A longtime member of the international tunicate community, he heads the Nishida lab with the Department of Developmental Biology of Osaka University's graduate school of science. DigitalMarine caught up with Hiroki at the International Tunicate Meeting 2019 in Villefranche-sur-Mer, France, to ask a few questions about his long history with tunicate models spanning more than three decades.

What is your area of research and interest in biology?

I am a developmental biologist and I've been working with tunicates for more than 35 years. I work more specifically with ascidians and also with appendicularians, both of which are tunicates, and I'm interested in the embryogenesis and larval development of tunicates.

What would you say is your specialty?

I'm interested in cell fate determination, which is how the fate of each cell is specified and determined when an egg starts to divide during embryogenesis. I'm also interested in the morphogenesis that shapes the embryos into larva that are tadpole-shaped.

Why did you choose tunicates as an experimental model, and what kind of advantages do you see in this model?

Well, there are two reasons: the first is that tunicates are closely related to vertebrates, when we look at a phylogenetic tree. But, when compared to the vertebrate embryo, tunicates show a very simplified embryogenesis and the developmental processes. For example, the embryos consist of a small number of cells, and the developmental processes are stereotyped and invariant between individuals, which provides a very good material to study embryogenesis and development. Secondly, various kinds of embryonic, cellular, and molecular experimental approaches are feasible.

How did you start working with tunicates?

As an undergrad student I studied ecology and animal behavior, then I changed the subject to developmental biology and I started studying tunicates when I began my PhD. At that time, I wanted to be a member of the lab that was already studying ascidian embryogenesis, and I immediately knew that embryogenesis was very beautiful, so I was really attracted by the embryos. This was 35 years ago, so this was before the molecular age started, and I just observed embryogenesis and labeled each cell of the embryo and traced its developmental fate. Those were really exciting experiences. I got really curious about examining which cell developed into which part of the larvae, and the experiments were really successful. So I started my career with cell lineage analysis. Then the molecular age came and I started to study how cell fate is specified by the gene products.

Do you remember a funny experiment or a fun event with ascidians?

I was interested in how muscle cell fate is determined. The presence of such a factor was predicted by Edwin Conklin more than 100 years ago, and I finally found the gene products that were localized to a certain part of the eggs. So yeah, we were thinking of how to name the gene, and it is muscle determining factor, so first we thought that we should give it a name like Popeye, after the cartoon character from the American animation, but after searching for Popeye in the biological field, there were already mutants in Drosophila named Popeye. Then we thought what the best name could be, and in the end we decided on "macho-1", and this is an abbreviation for *maboyano cho omosiroi idenshi 1* in Japanese, which means "particularly interesting gene in the ascidian". I was very happy to name it that because macho is originally Spanish but even in Japanese and English and French people in the world know what it means. So it's a muscle-forming factor and it's easy to memorize! And I put the "1" after "macho" because then it sounds like macho man. So those were some exciting days during my career!

What do you think is the future of tunicates as models?

We started to work with appendicularians, specifically *Oikopleura*, and we wanted it to be an emerging model for analysis of developmental biology. We started to use *Oikopleura* 15 years ago, and I was attracted to working with this animal because it's a beautiful and transparent pelagic tunicate, and the embryogenesis goes very quickly, so when the eggs are fertilized, they develop into the tadpole-shaped larva in just three hours. They are transparent and are very good material for live imaging, and moreover the entire life cycle is just five days, so the appendicul

An adult animal of the appendicularian, Oikopleura, that has full grown eggs in the gonad. The animal is 5 mm long. They sexually mature on 5th day after fertilization. Photo credit: Nishida Lab

-arians' life cycle falls in the middle between *C. elegans* and *Drosophila*. It will probably contribute to the analysis of tunicates in the future but the community is still very small, probably only seven or eight labs in all. I'm trying to increase the size of the community by bringing animals for example to China, and giving talks about appendicularians. I'm also teaching about tunicates and ascidians and the muscle determinants that are localized within the egg in my class lectures. I also sometimes gave talks for the general public and high school students so that they can learn about embryogenesis and how cell fates are specified, and I think maybe talking about the mosaic development could be easy for them to understand.

Could you say a few things about the tunicate community?

The size of the community is very good, and I find that people can be familiar with each other quite easily. At this International Tunicate Meeting, 150 people are attending, and everyone meets each other and spends five days together. We do this every two years in Japan, in the United States, and in different European countries. Actually, I like this meeting the most – I've attended various meetings with small groups and huge ones, but I find that the tunicate meeting is the perfect community size.

Close-up of the trunk and gonad regions of the appendicularian, Oikopleura. Mouth is on the left. Gonad is filled with eggs. Brain and digestive tract is visible in the trunk. Photo credit: Nishida Lab

To visit the website for the Nishida Lab:
http://www.bio.sci.osaka-u.ac.jp/bio_web/lab_page/nishida/index-e.html

Contact Dr. Nishida:
@ hnishida(at)bio.sci.osaka-u.ac.jp

Interview led by Dr. Christian Sardet, CNRS research director at the Observatoire Océanologique de Villefranche-sur-Mer, France.