



# CDB SEMINAR

## Yoshihiro Morishita

Department of Biology, Faculty of Sciences, Kyushu University

Tuesday, February 8, 2011

13:00 - 14:00 A7F Seminar Room

### **Mathematical approaches to developmental biology; geometrical analysis of organ deformation and coding design of positional information**

#### **Summary**

I would like to talk about the following two topics; (I) geometrical analysis of organ deformation and (II) coding design of positional information.

[I] During this two or three decade, many genes and signal transduction pathways related to morphogenesis have been identified. As for non-molecular events, in contrast, we have little macroscopic information such as the spatio-temporal patterns of organ deformation. In this study, we develop a new method to quantify organ deformation by using Bayesian approach from fate map data. We applied the method to chick hindlimb and succeeded in estimating the dynamic patterns of deformation modes such as volumetric growth rate. We also discuss how to relate the geometrical information with molecular information such as expressions of genes necessary to spatial patterning.

[II] Robust positioning of cells in a tissue against unavoidable noises is important in achieving normal and reproducible morphogenesis. The position in a tissue is represented by morphogen concentrations, and cells read out them and recognize their spatial coordinates. These processes can be regarded as an information coding problem from the engineering viewpoint. In order to quantitatively answer "how good coding is adopted in real organisms?" and "when, where, and to what extent does each morphogen contribute to the positioning?", we need a way to evaluate the goodness of coding. In this study, by introducing basic concepts in computer science, we mathematically formulate coding processes and defined some key concepts such as encoding and decoding of information. We prove the best coding designs and show the applicability of our theory in the context of vertebrate limb development and early patterning of Drosophila embryos.

#### **Host:**

**Shigeo Hayashi**

Morphogenetic  
Signaling, CDB  
[shayashi@cdb.riken.jp](mailto:shayashi@cdb.riken.jp)  
Tel:078-306-3185  
(ext:1523)

**RIKEN CENTER for DEVELOPMENTAL BIOLOGY (CDB)**