



CDB SEMINAR

Yusuke T. Maeda

The Hakubi Center for Advanced Research, Kyoto University
Japan Science and Technology Agency, PRESTO

Thursday, January 31, 2013

16:00~17:00 A7F Seminar Room

Coded polymer in thermal gradients: from the early life to pattern formation

Abstract

Atoms and molecules move along a gradient of external fields as seen in electrophoresis, which is a motion of charged molecules relative to fluid along an electric field. One unexplored but relevant alternative is thermophoresis, the Soret effect, that makes a solute moves along a temperature gradient. Here we present that thermophoresis has a great potential in biology, especially from the origin of life problem to pattern formation of molecules.

Thermophoresis depletes a polyethylene (PEG) polymer of large concentrations from the hot region and builds a concentration gradient. In such a solution, solutes of small concentration experience thermophoresis and PEG concentration-dependent restoring forces. Under focused laser heating, DNA and RNA as solutes localize as a ring-like structure which diameter monotonically decreases with their size following a behavior analogous to gel electrophoresis (Maeda et al. Phys Rev Lett 107: 038301 (2011)). Moreover, we show that the selection of small RNA depending on its stem-loop structure is also possible in a temperature gradient (Maeda et al. PNAS 109: 17972 (2012)). Thus trapping and selection of molecules could be physically feasible in a simple way relying on temperature gradient. Selection of RNA via temperature gradient might be relevant to molecular evolution at the origin of life: Separation of RNA from the large library of RNA world might occur at the thermal vent of the deep ocean where large temperature gradient is present. Moreover the control of concentration profile in microfluidics is shown in the end of this talk.

Host:

Shinichi Nishikawa
Stem Cell Biology, CDB
nishikawa@cdb.riken.jp
Tel:078-306-1893
(ext : 5301)

RIKEN CENTER for DEVELOPMENTAL BIOLOGY (CDB)