Meiji University Global COE Program

52th Mathematical Sciences based on Modeling, Analysis and Simulation seminar

Date: June 14, 2012, 16:30～18:00

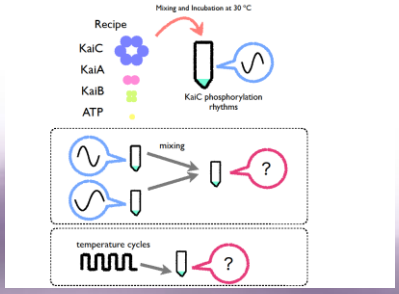
Location: Meiji Univ. Ikuta Campus, Build 2 Annex A, Room A207.

Hiroshi Ito (Kyushu University)

Title : Reconstitution and control of circadian clock in a test tube

Abstract : Circadian rhythms are periodical phenomena with a 24 hours period in living things. What is the central oscillator bringing us the rhythm? This tough issue has been tackled for several decades. My collaborator and I recently shed light on this issue by reconstituting a circadian clock in a test tube. Molecular biologists focused on the circadian rhythms of cyanobacteria fifteen yeas ago. They identified the three clock-related genes kaiA, kaiB, kaiC. When each gene is disrupted by means of molecular biological techniques, the cellular rhythms are abolished. A genetic network including the three genes had been thought to be the central oscillator of cyanobacterial circadian rhythm (Ishiura et al. Scinece 1998). However, we reconstituted circadian rhythms of KaiC phosphorylation by mixing the three proteins, KaiA, KaiB and KaiC with ATP in a test tube. The self-sustained oscillation suggests physiological circadian rhythms are consisted of biochemical oscillation without gene regulatory network (Nakajima et al. Science 2005).

In this seminar I will focus on the several findings after succeeding in the reconstitution. Cellular circadian rhythms in any organisms can be synchronized by environmental light or temperature cycles. I found temperature cycles could successfully entrain the reconstituted oscillator but light cycles failed (Yoshida et al. PNAS 2009). Also, the biochemical oscillator can synchronize among samples with different phases by mixing them (Ito et al. Nat Struct Mol Biol 2007). Cellular circadian rhythm is nullified by chilling it and the reconstituted biochemical rhythms also can not be observed at low temperature. I detected the type of bifurcation for the transition of rhythmicity. I will address the biological meaning of the bifurcation.



Everyone is welcome to attend the MAS seminar.

Meiji institute for Advanced Study of Mathematical Science (http://www.mims.meiji.ac.jp)

(Organizers: M. Mimura, D. Ueyama, Y. Wakano, K. Ikeda and S.Kinoshita)

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Access: 10 minutes on foot from Ikuta St. Odakyu line,
Or 10 minutes by bus No. 13「明治大学正門前」, get off at the last stop.
See http://www.meiji.ac.jp/koho/campus_guide/ for details.