CDB SEMINAR

Speaker: Hideo Iwasaki

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Title: "A Paradigm Change in the Circadian Clock Research: Genome-wide transcription rhythms driven by a protein-network-based clock in cyanobacteria"

Date:	**Wednesday, June 15**
Time:	**16:00 -17:00**
Place:	**1F Auditorium of Building C,CDB**

Summary:

Circadian rhythms are endogenous oscillations with a period of ~24 h and observed from bacteria to higher plants and mammals. A dogmatic model has been believed in any model organisms that circadian oscillations are driven by an autoregulatory transcription/translation feedback loops. However, we recently broke this 'Central Dogma in circadian clock research' in cyanobacteria.

Cyabacteria are the simplest organisms known to show circadian rhythms. In the cyanobacterium *Synechococcus elongatus*, almost all gene promoter activities show circadian rhythms. Such transcriptional rhythms require three clock genes, *kaiA, kaiB* are *kaiC*. KaiC shows circadian change in its phosphorylation state. We found in continuous dark conditions that the KaiC phosphorylation cycle sustained even after all clock gene transcripts disappeared and *de novo* transcription and translation were abolished in the presence of excess transcription/translation inhibitors.

KaiC has both autophosphorylation and autodephosphorylation activities that are modified by KaiA and KaiB. KaiA, KaiB and C proteins form transient complexes during a circadian cycle. Thus, we proposed that a protein dynamics among the three Kai proteins is the core of circadian timing mechanism in cyanobacteria. Indeed, at Dr. Takao Kondo's lab in Nagoya University, we succeeded in reconstitution of circadian oscillation of KaiC phosphorylation *in vitro* by incubating the three Kai proteins with ATP. Finally I will report our recent genetic and genomic studies to reveal mechanisms by which the Kai-based chemical oscillator drives genome-wide circadian transcription rhythms in *Synechococcus*.

1. Tomita, Nakajima, Kondo, Iwasaki (2005) *Science*, 307: 251-254
2. Nakajima, Imai, Ito, Murayama, Iwasaki, Oyama, Kondo (2005) *Science*, 308: 414-415
3. Iwasaki, Nishiwaki, Kitayama, Nakajima, Kondo (2002) *PNAS*, 99: 15788-15793
4. Iwasaki, Williams, Kitayama, Ishiura, Golden, Kondo (2000) *Cell*: 101: 223-233
5. Iwasaki, Taniguchi, Ishiura, Kondo (1999) *EMBO J.* 18: 1137-1145

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