CDB SEMINAR

Masashi Mori

European Molecular Biology Laboratory (EMBL)

Monday, December 10, 2012

15:00~16:00 C1F Auditorium

Actin-driven chromosome transport in starfish oocytes

Summary

Chromosome congression and segregation is thought to be mediated by the dynamic spindle microtubules in dividing cells. However, our lab showed that in starfish oocytes actin filaments play an essential role in chromosome congression and are required to deliver chromosomes to the "reaching distance" of the spindle microtubules in this exceptionally large cell. However, the mechanism of actin-driven chromosome transport remained unclear.

Here, we combined quantitative imaging and image analysis to follow chromosomes and actin structures at high spatiotemporal resolution in live oocytes. After nuclear envelope break down, we can observe meshwork structure of actin filament. This meshwork has flow toward spindle, and chromosomes move with this flow. From the trajectories of the meshwork flow and chromosomes, we found that the both motions of actin filaments and chromosomes show the linear dependence of velocity and travel distance. These data allows us to establish a homogeneously contracting meshwork model which is anchored to the cell cortex. If we injected inert beads into the nucleus, the beads above a certain size are transported as chromosomes, whereas smaller beads tend to diffuse. These observations suggest that meshwork acts as a fishnet and thus transports any particles above a size cut-off. Finally, by further perturbation of the actin meshwork, we found new actin filament production from nuclear envelope remnant is required for proper actin meshwork contraction.

Taken together, we propose a fundamentally new mechanism of cytoskeletal transport that relies on a filament meshwork with a sufficiently dense mesh size to capture chromosomes without the requirement for specific binding.

Host:
Tomoya Kitajima
Chromosome Segregation, CDB
tkitajima@cdb.riken.jp
Tel:078-306-3346 (ext:4447)