The 181st iCeMS SEMINAR

Tue 25 Nov 2014
10:00-12:00

Venue:
2nd Floor Seminar Room (#A207)
iCeMS Main Building (#77), Kyoto University

<Part 1: 10:00-11:15>

Professor Françoise Brochard-Wyart

Institut Curie-PCC Curie-UMR 168,
Université Pierre et Marie Curie, Paris France

Soft Matter models of tissue "wetting of living drops": Spreading and motility of cellular aggregates

<Part 2: 11:15-12:00>

Dr Grégory Beaune

International Center for Materials Nanoarchitectonics (MANA) and National Institute for Materials Science

"Characterization of phosphorylcholine-modified chitosan films that promote the formation of cell aggregates and spreading of cell aggregates"

Contact: iCeMS Chen Group at chen-g@icems.kyoto-u.ac.jp
Hosted by: iCeMS (Institute for Integrated Cell-Material Sciences), Kyoto University

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Abstracts for November 25 iCeMS Seminar

Prof Françoise Brochard-Wyart *<Part 1: 10:00-11:15>*

In the field of "Active Matter," active processes in both living and non-living matter create a novel class of nonequilibrium materials composed of many interacting units that individually consume energy and collectively generate motion or mechanical stresses. Active systems span an enormous range of length scales, from the cytoskeleton of individual living cells, to animal groups such as bird flocks, and insect swarms. By analyzing the tissue mechanical properties of multicellular aggregates using a new pipette aspiration technique, we characterized the biomechanics of these aggregates, which exhibit a mechanosensitive viscoelastic response of the acto-myosin cortex. We then studied the spreading of aggregates on rigid and soft substrates, and found that the dynamics of spreading results from a balance between active cellular driving forces and permeation of cells to enter into the film. Finally we found that the motility of aggregates on soft substrates leads to symmetry breakdown and a global motion of the aggregate. We describe the flow field and the force field responsible of the motion. We will also show strong similarities between aggregates of ants and cells!

Dr. Grégory Beaune *<Part 2: 11:15-12:00>*

Cellular aggregates are important for tissue engineering and pharmacological studies. For in-vivo implantations studies, it is preferable to assemble spheroids directly on the biomaterials to be implanted. I will describe the elaboration and characterization of chitosan-phosphorylcholine (CH-PC) films able to support the formation of cell aggregates. Then, I will focus on cellular aggregates used as model system of tumors. When deposited onto fibronectin-coated glass or polyacrylamide gels, they adhere and spread by protruding a cellular monolayer that expands around the living droplet. The dynamics of spreading results from a balance between the pulling forces exerted by the highly motile cells at the periphery of the film, and friction forces associated with two types of cellular flows: i) permeation, corresponding to the entry of the cells from the aggregates into the film, and ii) slippage as the film expands. We characterize these flows by using fluorescent tracking of individual cells and particle imaging velocimetry of cell populations. Also we study the spreading in function of the substrate rigidity. Our results demonstrate that the mechanical properties of the environment influence the balance of forces that modulate collective cell migration.

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